**Project Document**

# A sub-national public-private strategic alliance for innovation and export development: the case of the Canadian province of Alberta's oil sands

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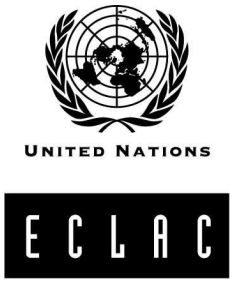



Economic Commission for Latin America and the Caribbean (ECLAC)

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# Contents

# Abstract

The present paper addresses the Alberta oilfield experience and draws up a set of principles for strategic public-private alliances for innovation and export development considered useful for the Latin American countries. According to the authors the lessons to extract are not reduced to countries with abundant hydrocarbon resources, and may be also useful to broader applications as the development of innovation in resource based industries, the construction of strategic public-private alliances and consensus building, the royalty regime, the appropriate fiscal policy, securing investments in technology development and in human capital, and a stable and balanced regulatory framework. However, the authors state that the challenge to recognize the lessons is not an easy task, because of the fact that they can come not just from what occurred but also from what didn't happened.

# I. Introduction

This scene could have played out anywhere in the world: The year is 2007. Popular discontent in the governing party forces the leader to step down. There are no revolutions; it all transpires in the most democratic of ways. His replacement, keenly aware of the general unhappiness, promptly calls on an independent advisory commission to provide recommendations that would correct the problems. After extensive consultations with the private sector, NGOs, experts, and the public at large, the commission makes its recommendations public. Mayhem ensues.

The private sector threatens to stop all new investment if these recommendations are implemented. NGOs are cautiously optimistic but only if the government implements all of the recommendations. Experts are divided into two extreme camps: either totally in favour, or totally against. The polarization of opinions only serves to confuse the public.

The government cautiously makes a decision. It attempts to strike a balance by accepting some recommendations while rejecting the most contentious ones. Moreover, it determines that implementation of these new measures will only take place one year from that date —clearly enough time to gauge the reaction, adapt, and fight an election. No one is satisfied.

That the issue at stake involves the resource sector and specifically, a review of the royalty rates charged from oil and gas production, is not surprising. After all, in these days where crude oil is fetching a record US$130 per barrel, resource nationalism is on the rise. The country in question, however, is unexpected. This drama is taking place in Alberta, Canada –a province and country of enormous wealth, which has consistently made it to the top six out of 177 countries in the United Nations Human Development Index[1]. And fuelling the Canadian economy is a robust oil and gas sector, chiefly in the province of Alberta, which, like all provinces in the Canadian federation, has jurisdiction over its natural resources.

Although in general one could say that, since the discovery of oil in Leduc, Alberta in 1947, the development of the sector is a story of almost uninterrupted success —with Canada being self-sufficient in oil and gas and a net exporter almost exclusively to the U.S.[2]— this statement would hide much. In fact, if it wasn't for the monumental efforts of the Alberta government combined with the

[1] United Nations. Human Development Index. Accessed on November 21, 2007 http://hdr.undp.org/en/

[2] Canada is a net exporter because while it has excess production in Western Canada, which is exported to the U.S, Eastern Canada needs to import crude to meet domestic demand.

ingenuity and collaboration of the private sector, and at times with the intervention of the federal government, the tale could have been one of unfulfilled potential.

There are many valuable lessons to be learned from this experience. Some are easy to extract. They involve developing a long term strategic vision compatible with the extended payouts involved in innovation, detailing processes, including strategy development, the choosing of exploration contracts, the royalty regime, the appropriate fiscal policy, securing investments in technology development and in human capital, and a stable and balanced regulatory framework. Other lessons, perhaps of even greater value, are much more subtle, and thus challenging to distill and articulate. They involve the political settings that lead to certain decisions being made. They involve the governance of the institutions charged with realizing the objectives put forth by governments. They involve the building of consensus in society and terms of engagement with the private sector. The challenge of identifying these lessons is magnified by the fact that they can come not just from what occurred, but also from what didn't happen. It is often difficult to recognize an important process, principle, or development whose absence has resulted, in a less than desirable outcome.

This issue is central to the objective of this paper, which is to draw up a set of useful principles for strategic public-private alliances for innovation and export development from the Alberta experience in early development of the oil sands, derived from both the obvious and the subtle elements. In particular, the focus will be to examine the changes and initiatives put in place in the 1970s which, unquestionably, set the tone for all future resource development in the province. The principles derived will undoubtedly be helpful not only to those interested in understanding how Alberta and Canada have dealt with the country's oil and gas resources, but also to the many countries in Latin America, from Mexico to Trinidad and Tobago, from Bolivia and Peru to Brazil and Argentina, as they attempt to realize the potential offered by their abundant hydrocarbon resources. However, there are broader applications for many of these lessons, extending to countries pursuing innovation in resource based industries, even to other areas of governance and private enterprise as well as the construction of strategic public-private alliances and consensus building.

# II. Some antecedents

When it came to hydrocarbon resource development in Alberta, the issue at hand was that although the province had sizeable oil and gas conventional reserves[3], the real potential was locked up in the mammoth oil sands reservoirs of its northern regions[4]. And the challenges associated with turning this thick and gooey substance into commercial fuel were colossal. Apart from difficulties presented by the remoteness of the location and the extreme harshness of the climate, producing oil from the sands required considerable technological advancements in extraction and processing technologies and the construction of extensive infrastructure —from extraction plants, to upgraders, to pipelines, to roads, to housing, and everything needed to support the large labour force required to build and operate these plants. All of this translated into massive investment needs.

Although there had been attempts to develop this resource since the 1920s, the efforts came and went, and were always conditioned by the inherent conflict between the interests of the conventional hydrocarbons sector and those of the potential oil sands producers. Conventional resource producers guarded their markets jealously, and both groups demanded preferential royalty and fiscal regimes, incentives for technology development, and lobbied vigorously for the placement of infrastructure to meet their own needs. Unfortunately, these deposits existed in different geographical areas, had different technological needs, and, most difficult of all, the possible markets were limited to either the small domestic market, or the U.S. Furthermore, governments were dependent on revenues generated by the production from conventional sources, resulting in a reluctance to enact policies that would ensure oil sands development. Not surprisingly, under these circumstances, attracting the necessary investment was very difficult.

By the late 1960s the Great Canadian Oil Sands (GCOS)[5] was the only group producing oil from the northern sands. Another consortium, Syncrude Canada Ltd. —formed by Cities Services, Imperial Oil, Royalite, and Atlantic-Richfield— was interested and did obtain the necessary permits in 1969. Still, Syncrude was struggling to put the financing in place.

This was the scenario facing Peter Lougheed, the first Conservative premier elected in the Province of Alberta, when he took power in September of 1971. His election came in the wake of 36

[3] In accepted industry terms, oil and gas coming from traditional reservoirs are called conventional while production from oil sands, shale, coal to oil schemes, etc. is called unconventional.

[4] Note that, in the context of this text, oil sands and bitumen are used as synonymous.

[5] Today GCOS is Suncor, a Canadian company. However, back then, the majority shareholder was Sun Oil from Pennsylvania.

years of uninterrupted rule by the Social Credit party, and after an election campaign driven by promises of change. Chief among Mr. Lougheed's plans for the province was his declared objective to turn the oil sands into an economically viable resource. The new premier made good on his promises. He changed the royalty rates, invested directly in Syncrude as well as in pipelines and other commercial ventures, established new research authorities, and created the Heritage Fund, a new "savings" fund which would be a legacy for future generations.

His tenure lasted 14 years, and other Conservative governments succeeded him. Today, 36 years later, the oil sands are the motor of the Alberta economy, and the province has the hottest economy in Canada. It leads the country in a number of areas, among them: employment, migration, net investment, and growth. For instance, according to the Fraser Institute, a leading think-tank, Canada's real growth in 2006 was 2.8 percent, while Alberta's was 4.4 percent[6]. The financial picture is also stellar. The province has run surpluses for the last 14 consecutive years —Cad$ 8.5 billion last year alone[7]— and has paid off its debt.

But there is another side to this happy story. Production from oil sands tends to have a greater impact on the environment than production from conventional sources. Exact numbers are difficult to pin down because impacts vary widely depending upon how the oil sands are produced (i.e. mining, in situ or cyclic steam stimulation). Consequently, estimates comparing oil sands greenhouse emissions to that of conventional production range widely from 3.0[8] to as low as 1.24 times higher[9]. Water usage in the production of oil sands is also higher than in conventional production. In addition, waste recycling is far more challenging. To these woes, add other impacts from the rapid growth in oil sands projects such as labour shortages, deteriorating services, and an overall sentiment of a decline in the quality of life, and Albertans have been left feeling that the government completely mismanaged the pace of growth. Their reaction was to withdraw support for long-time Premier Ralph Klein, who opted to retire after receiving no more than lukewarm support at his party's leadership review. His successor, Ed Stelmach[10], initially faired no better. Immediately after the announcement of the changes to the existing royalty scheme, in October 2007, the approval rating of the Conservative government tumbled to an all-time low of 33 percent[11]. The months that followed were among the most polarized in Alberta's history. On one side of the divide were the oil companies with warnings of imminent disaster if the changes were implemented. On the other side the government and a few academics maintained that it was time to update the royalty regime to reflect increasing oil prices and bring about a slowdown in the pace of development. Although the public at large appeared confused at first, they threw their support behind Mr. Stelmach. He surprised everyone by winning a solid majority on the March 3rd elections —forming the 11th consecutive provincial Progressive Conservative majority government.

One might conjecture that the roots of the current troubles facing Albertans and their government are grounded in the evolution of the sector, and the complex relationships between government and private enterprise. It is worth analyzing how decisions were and are made, and what is understood by consensus, and the processes that have been used to reach it. However, before we delve into issues of governance, the ABCs of oil and gas in Alberta will provide the necessary foundation to understand the larger issues.

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6 Fraser Institute, phone conversation with the chief economist, need to get proper reference

7 Government of Alberta. Department of Finance. 2007 http://www.finance.gov.ab.ca/publications/budget/budget2007/fiscal.pdf. (accessed on August 12).

8 Woynillowicz, Severson-Baker, and Raynolds, Oil Sands Fever, 22.

9 Farrell, Alexander and Daniel Sperling et al. Low Carbon Fuel Standard for California: Part 1, Technical Analysis, page 54, table 3-2. University of California at Berkeley, May 2007.

10 Ed Stelmach was elected leader of the Conservative Party of Alberta and became the 13th Premier of Alberta in December, 2006.

11 Henton, Darcy. "Tory Support Tumbles after Royalty Decision," Calgary Herald, November 1st, 2007. Page A1.

## A. The basics

Canada is among the world's largest energy producers and exporters. According to a recent report from the International Energy Agency (IEA), it is the only member country with growing indigenous oil production[12]. However, this incremental production is expected to come from unconventional sources, as Canada's conventional oil production is currently declining.

The story is compelling. Conventional oil reserves are estimated at approximately 5.2 billion barrels, proven recoverable unconventional reserves are 174 billion barrels, second only to Saudi Arabia, and potential unconventional reserves stand at 315 billion barrels. Nonetheless, while total oil production in Canada has gone from 1.99 million barrels per day (mmb/d) in 1996 to 2.67 mmb/d in 2006, conventional production declined while bitumen (oil sands) production went from 430,000 b/d to 1.22 mmb/d during the same period[13].

## B. The nature of oil sands

Oil sands are a mixture of sand, bitumen, mineral-rich clays and water, and are substantially more viscous than other types of crude oil. Alberta's oil sands extend over some 140,000 square kilometers in the north and eastern parts of the province, with the bulk of the activity centred at approximately 450 kilometers north of Edmonton, Alberta's capital city. Although the Alberta Research Council had identified specific oil sand areas early on, the definitions became more precise in the early 1970s, and four oil sands areas were identified: Athabasca, Cold Lake, Peace River and Wabasca, each with its own unique physical properties and each requiring its own unique combination of know-how and technology to be commercially developed[14].

Of the total reserves only about 20 percent can be extracted by surface mining with very large draglines and/or truck and shovel. The rest is at a depth of greater than 75 meters, and must be extracted in situ. Adding to the challenge is the fact that these reserves lie beneath thousands of tonnes of muskeg, sandstone and shale, much of which is frozen for more than half of the year. In geological terms, the resource is relatively shallow with low formation temperatures, which means that it must be heated to make it viscous enough to flow to the surface[15]. Current recovery and upgrading technology processes use natural gas as the fuel of choice.

The technological challenges, which are many, will be discussed further in this chapter. However, the dependence on natural gas in the production of heavy oil, particularly in situ bitumen is extremely problematic for a number of other reasons as well.

First, natural gas is in itself a prized hydrocarbon —with a much smaller environmental footprint than unconventional oil. Consequently, using a cleaner hydrocarbon to produce a low-grade fuel that still needs to be upgraded and refined seems counterproductive and certainly unsustainable in the long run. And second, just as with oil, conventional natural gas production in Canada is in decline. New production will come from unconventional sources (coal bed methane, tight and shale gas) and from frontier exploration (Mackenzie Valley and offshore Nova Scotia). This situation implies increasing costs and in the case of unconventional gas, further environmental challenges. It is not clear that supply will be sufficient, given the increased demand and timelines for development.

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12 IEA, Oil Supply Security, Emergency Response of IEA Countries 2007, 86, November 2007.

13 Government of Canada, Various reports, National Energy Board, www.neb.gc.ca.

14 Bowman, C.W. and G.W. Govier, Status and Challenges in the Recovery of Hydrocarbons from the Oil Sands of Alberta Canada, Contribution to Tenth World Energy Conference, Istanbul, Turkey, September 19-24, 1977.

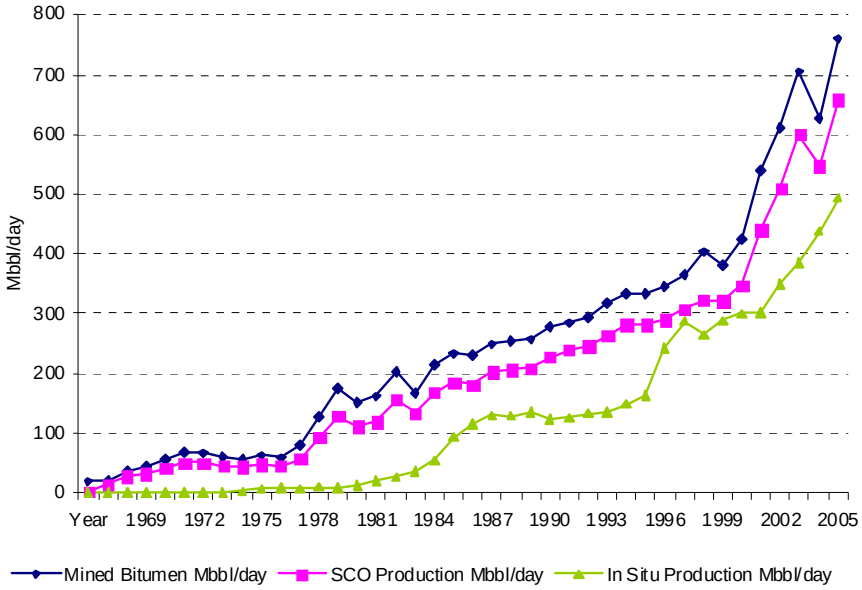
15 By comparison, the oils sands of the Orinoco Belt in Venezuela lie at greater depths, and consequently, can be extracted without the introduction of additional heat.

In the end, the environment might prove to be the Achilles heel of oil sands production. As mentioned before, by any measure, unconventional oil production's greenhouse gases emissions are higher than for conventional production. And, although emissions per barrel have declined, production increases have far outpaced all efficiency gains. Given this fact, in a carbon-constrained world, the future competitiveness of Canadian production is at stake. Moreover, oil sands production is extremely water intensive, which is another issue that is certain to become front and centre in the years to come. Here again, although many improvements have been made —with much of the water used in both mining and in situ operations being recycled— the needs for increasingly scarce fresh water are still substantial. Finally, the impact of water usage also includes the left-over product of the mining operations —a mixture of bitumen, water, sand, silt, and clay particles— which is deposited into tailing ponds. Currently they cover an area greater than 50 square kilometers, and to date, no economically attractive technology exists to reintegrate this material safely into the landscape[16].

All of this is taking place now, after approximately Cad$30 billion have been invested in this sector (figures 1 and 2 show the evolution of oil sands production in Alberta). However, the magnitude of what is to come has yet to sink in. Estimates are for that investment to mushroom to Cad$125 billion in the next decade, leading to a substantial increase in production[17]. According to the Alberta government's own projections, oil sands production could top 3 million barrels per day by 2020 and possibly even 5 million barrels per day by 2030[18].

Undoubtedly, given the current push for policies that account for environmental degradation, significant technology advancements will need to be made for the projected levels of production to be reached. Perhaps revisiting how the last big technological leap was achieved might prove useful. For that, one needs to go back three decades, to Premier Lougheed's time in office.

**FIGURE 1**
**ALBERTA MINED BITUMEN, SYNTHETIC CRUDE AND IN SITU PRODUCTION**




Source: Alberta Energy and Utilities Board.

16 The technology currently applied will probably adequately reintegrate the material, however, it would be done over an agonizingly long time period. Consequently, better technology and reduced water requirements are badly needed.

17 Hester, Annette, and Sidney Weintraub. 2007. Canada Chapter, in Energy Cooperation and Impediments in the Western Hemisphere, ed. Sidney Weintraub, with Annette Hester and Veronica Prado. Washington, DC: CSIS (April) 71.

18 Government of Alberta, http://www.energy.gov.ab.ca/OurBusiness/oilsands.asp [accessed on November 23, 2007]

## C. Peter Lougheed's era

In a speech to the Calgary Chamber of Commerce on September 6, 1974, Premier Peter Lougheed noted that certain principles underpinned his government's policy, among them: reducing the dependency of Albertans on government, or on corporations directed from outside the province by "accomplishing this as much as possible through the private sector, and moving through the public sector only if the private sector is unwilling or unable to move in new direction." His strategy was to obtain fair market value for the sale of Alberta's natural resources, to encourage economic diversification; to balance growth throughout the province by decentralization, and to upgrade the skills of Alberta citizens[19].

Behind these words was Mr. Lougheed's conviction that Alberta had to take control of its resources. He was no "buddy" of Big Oil, neither was he subservient to the federal government. As a matter of fact, federal-provincial relations during his tenure and that of Prime Minister Pierre Elliot Trudeau, who was in power from 1968-79 and 1980-84, were probably the most contentious in Canadian history.

The tone was set in a meeting between the two leaders two months after Lougheed was sworn in as Premier. The conversation took place in Ottawa, in November 1971, and the discussion was centered on "the changing and growing impact of western Canada on the rest of the country and Alberta's desire to be consulted prior to discussions of natural gas and oil matters between the federal government and the United States[20]." Although one can imagine that Trudeau was a polite host, he had no intention of allowing the province of Alberta a say in international affairs. The two were certainly visionary leaders, except their visions, for most part, were at odds with one another. Although both were committed Canadians, Pierre Trudeau believed that the interests of Canada were above all others —including the provinces— while at a minimum, Peter Lougheed believed the interests of both jurisdictions were equal.

Needless to say, the oil shocks of 1973 and 1979 only served to aggravate this situation further. Faced with two substantial increases in the price of oil in the world markets —which affected the supply to a substantial portion of the Eastern Canadian markets— the federal government enacted a number of policies aimed at increasing energy security. That meant using a variety of policy instruments to ensure the decline of oil exports to the U.S., increasing Canadian ownership of the sector especially via the creation of Petro-Canada, a state-owned oil company in 1975, as well as encouraging exploration in federal lands and increasing the federal government's revenues from the sector. The policies also included a differentiated price for oil sold in Canada that was lower than the world prices. The rollout of these policies took place in September of 1973 with the imposition of a tax on oil exports, and culminated with the enactment of the National Energy Program (NEP) in October 1980. Ultimately, the NEP's main objective was to be an enabling mechanism for Canada to achieve oil self sufficiency.

According to the Canadian Encyclopedia:

> *The NEP, one of the most sweeping government policies ever undertaken in Canada, was dismantled by the Progressive Conservatives after their 1984 election victory. Although the NEP did reduce Canadian dependence on oil and foreign ownership of the oil industry, its chief legacy was one of distrust of the federal government by the western provinces*[21].

As expected, Peter Lougheed fought hard to defend Alberta's interests. He attempted to respond to each policy enacted by the federal government with one of his own. At times the objective

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19 Woods, David. The Lougheed Legacy, Key Porter Books, Toronto, Ontario, 1985, 125.

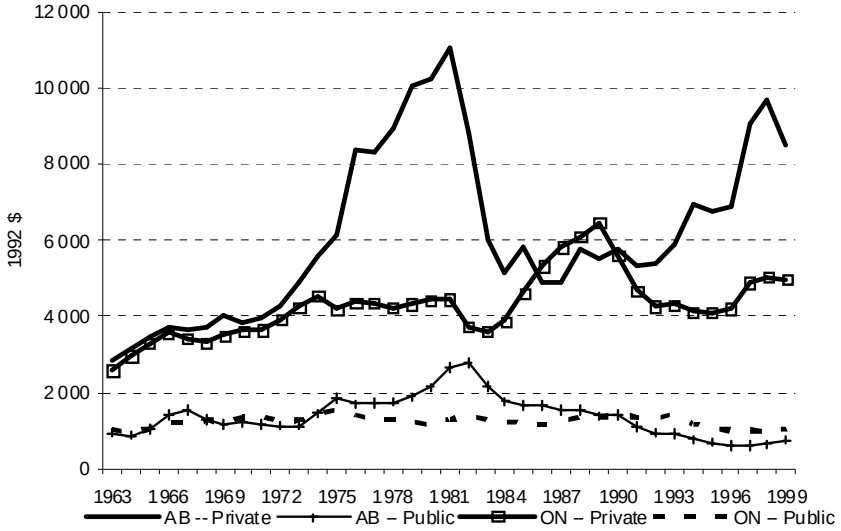
20 Ibid, 137.

21 Bregha, François. "National Energy Program," Canadian Encyclopedia, http://www.thecanadianency clopedia.com/index.cfm?PgNm=TCE&Params=A1ARTA0005618 [accessed on November 25, 2007]

was simply to neutralize the negative impacts of a specific measure. On other occasions, the objectives were more complex, as in the case of challenging the federal government in court over the Natural Gas and Gas Liquids tax. All along, however, Mr. Lougheed was building a foundation to afford Alberta as much independence as possible in developing its natural resources. In particular he established the Heritage Fund in 1976 with an original endowment of Cad$1.5 billion —a move that preempted the effectiveness of any federal government threat of withdrawing transfer payments. But all else pales in comparison with Lougheed's final response to the NEP. Shortly after its establishment, Alberta announced it would reduce oil production and shipments to Eastern Canada, in three installments of 60,000 barrels per day. The first took place on April 1, 1981, the second on June 1, and the last one, which ended up not taking place, was scheduled for September 1. Instead, on that date, Lougheed and Trudeau signed the Energy Accord, which dealt with pricing, taxation, and incentive issues[22].

These were turbulent times for the industry. Caught in the crossfire, companies tried to assess where the opportunities lay. Given the upheaval generated by both federal and provincial policies, investors grew leery. According to economic historian Herb Emery, "the NEP had dramatic effects on oil exploration and development in Alberta. The number of drilling rigs in Western Canada fell from 550 [on] the eve of the NEP to 120 by 1982, while over the same period of time, the number of drilling rigs in the United States increased from 2,100 to 4300[23]." Emery cites Robert Mansell and Michael Percy's assessment that, as a result from the NEP, "an exodus of an estimated Cad$11.5 billion in investment expenditures … set in motion a negative multiplier-accelerator process that, by 1982, had spread the effects to almost every component of the provincial economy[24]." Figure 3 illustrates the decline in investments.

**FIGURE 2**
**PRIVATE AND PUBLIC INVESTMENT PER CAPITA, ALBERTA AND ONTARIO 1963 TO 1999**




Source: Herb Emery.

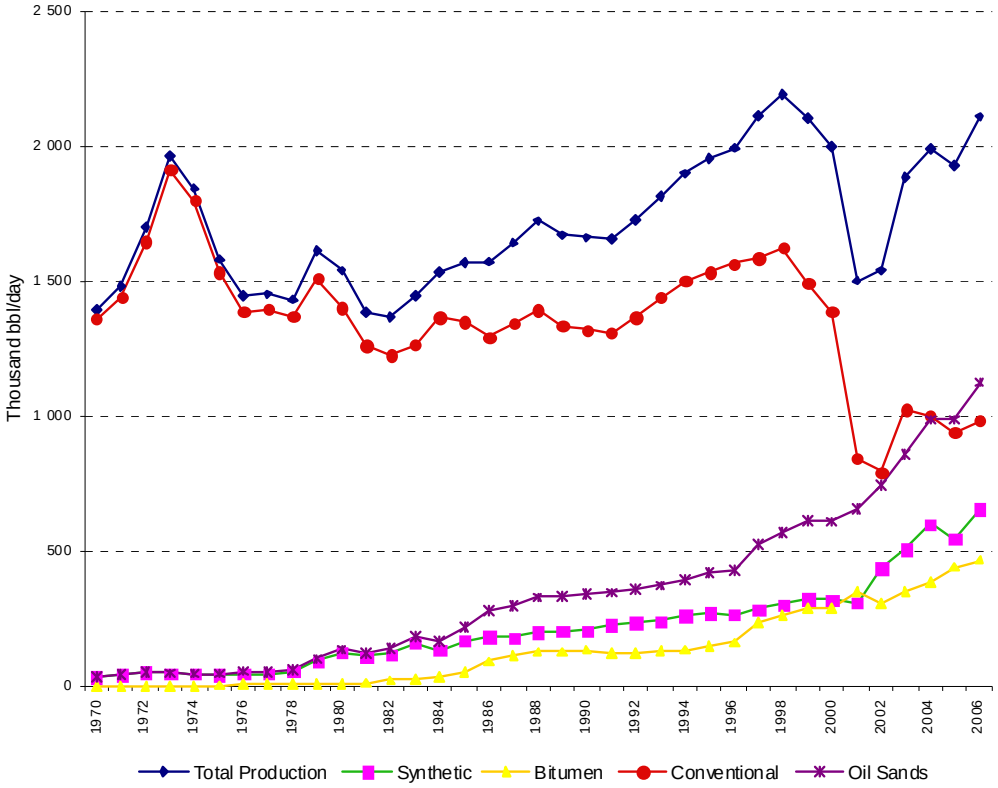
22 Woods, David. The Lougheed Legacy, Key Porter Books, Toronto, Ontario, 1985, 180 and Nemeth, Tammy (2005), "Duel of the Decade", Alberta formed Alberta transformed, Ed. Michael Payne, Donald Wetherell, and Catherine Cavanaugh, Edmonton, University of Alberta Press, 690.

23 Emery, Herb.(2005) "1986: The Bloom Comes off the Wild Rose," in Alberta Formed, Alberta Transformed, Ed. Michael Payne, Donald Wetherell, and Catherine Cavanaugh, Edmonton, University of Alberta Press, 710.

24 Robert L. Mansell and Michael B. Percy, Strength in Adversity: A Study of the Alberta Economy(Toronto: C.D. Howe Institute, 1990), 31-32, in Emery, Herb.(2005) "1986: The Bloom Comes off the Wild Rose," in Alberta Formed, Alberta Transformed, Ed. Michael Payne, Donald Wetherell, and Catherine Cavanaugh, Edmonton, University of Alberta Press, 710.

In terms of oil production, the story is not much better. Figure 4 shows that oil production peaked in 1973, declined sharply after the first oil shock, and hit bottom after the announcement of the NEP and the recession of the early 1980s. It took over a decade for the industry to recuperate completely.

**FIGURE 3**
**OIL PRODUCTION IN CANADA**




Source: AEUB.

While American firms and multinationals operating in Alberta suffered, they had many other places they could turn to. In contrast, although domestic producers might have had some preferential treatment, with prices in Canada regulated at lower levels than the international markets, their options were much more limited, especially when it came to financing. These were difficult times for oil and gas in Alberta. Nevertheless, turbulent times present unique opportunities. And for the most part, Premier Lougheed was astute enough to capitalize on them.

A great number of Mr. Lougheed's ideas were extremely controversial. In normal times, their successful implementation would have required much public debate and extensive consultation with industry. But during the time of the oil shocks and the ensuing recession, there was a greater acceptance of the government's heavy hand. Although the business sector did oppose certain measures with some vigor, it appears that Albertans in general supported Mr. Lougheed, understanding that to deal effectively with the federal government, especially with the strong and charismatic Prime Minister, a strong counterpart was required.

For instance, although the Premier encountered some protest early in his tenure when he fired the first shot substantially raising the royalty rates on conventional oil from 16.7 percent to 23 percent and then, a few months later, unilaterally declaring that royalty rates would rise with the world price, there is no comparison with the public outcry the 2007 royalty review has elicited. This was the case in spite of the fact that, according to historian Paul Chastko, on the issue of the change in royalties,

there were no previous consultations with industry, which, much like the reaction today, led executives to grumble that the province had broken contracts[25].

In fairness, it is likely that during those years, especially during the tense negotiations with the federal government, there wasn't much time for consultation. That said, many astute observers claim there wasn't much inclination to consult either. Fortunately for Mr. Lougheed, these instant demands suited his management style quite well. He was comfortable making tough decisions and consulted only with a very small core of advisors. In any event, he didn't believe that he had been elected to have consultations. As far as he was concerned, he had been given a mandate to look after the interests of the people from Alberta, and that was what he was doing[26].

It is interesting to note that when the interests of Canadians, as defended by Pierre Trudeau, coincided with those of Albertans, as seen by Peter Lougheed, the two men did find common ground and cooperated. The story of the partnership that led to the successful construction of the Syncrude oil sands mining operation is a case in point.

## D. The Syncrude story

Although Syncrude received all necessary permits in 1969, it took them until 1973 to finalize the provisions for the royalties and fiscal terms. At that time, these arrangements were negotiated on a project-by-project basis. Lougheed's main objective was for the project to start. However, he also wanted to secure the best deal for the people of Alberta. In his terms that meant, "if the project were profitable, the government would reap some of the rewards, but if the project were struggling, it wouldn't be killed by governmental demands[27]." Moreover, there was the intent of finding a way for Albertans to participate as stockholders in some aspect of the venture[28]. To fulfill these objectives Peter Lougheed determined that the province should receive 50 percent of the venture's profit by way of a royalty. This was a departure from the previous agreement with the GCOS which pegged the royalty at a percentage of production value. That is, if the enterprise was to succeed, the province would be assured half of the profits. The new deal also depended on the collaboration of the federal government which allowed Syncrude to treat the profit-sharing agreement as a normal tax royalty (allowing for deduction of royalty payments from the federal tax calculations)[29]. The other terms included a requirement that Alberta secure an 80 percent equity position on the pipeline taking the crude from the oil sands to Edmonton, as well as a 50 percent ownership of the project's power provider. Furthermore, the negotiating team insisted that the province retain the right to 20 percent interest on the venture after seeing what final costs and probable profits would be[30].

It took a while for the consortium to agree to these very unusual and detailed requirements, but an agreement was reached in August, 1973. Plant construction started almost immediately, but cost overruns meant that by the end of 1974, the consortium began to unravel. Atlantic Richfield decided its investments on the north slopes of Alaska were going to command much of its available resources, and announced it was abandoning its 30 percent stake in Syncrude.

Faced with the possibility of the project not going ahead, the provincial government managed to convince the federal government to take up a 15 percent equity position. Alberta itself took a 10 percent position, and secured a contribution from the Ontario government that gave it a 5 percent stake in Syncrude. However, Alberta's contribution went further than that. Alberta Energy Company, the provincially owned company that had obtained the 80 percent stake in the pipeline and 50 percent of

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25 Chastko, Paul (2004), Developing Alberta's oil sands: from Karl Clark to Kyoto, Calgary, University of Calgary Press 155.
26 Lougheed, Peter. Personall interview, September 2007.
27 Woods, David. The Lougheed Legacy, Key Porter Books, Toronto, Ontario, 1985, 113.
28 Ibid, 113.
29 Chastko, Paul (2004), Developing Alberta's oil sands: from Karl Clark to Kyoto, Calgary, University of Calgary Press 151.
30 Woods, David. The Lougheed Legacy, Key Porter Books, Toronto, Ontario, 1985, 114.

the power generation negotiated in 1973, assumed 100 percent of both operations. Although this represented additional investments, these two elements were the only assured profitable parts of the venture. His rationale was that regardless of the profitability of the whole venture, power generation and transportation were production costs which would be incurred as long as there was production. Furthermore, Alberta loaned Cad$200 million to Gulf and Cities Services to help finance their participation. This loan was later converted to equity.

Although by the late 1980s Alberta had recovered its investments, in 1975, when the deal was struck, there were as many doubters as supporters. However, the noted Canadian think-tank The C.D. Howe Research Institute observed that, "there is a constructive role to be played by governments as risk-sharers in cases where there is a sense of national urgency in getting a project going[31]…"

This was such a case. Although it should be noted that GCOS was already in operation, its size was deemed inefficient for oil sands production (diseconomies of scale). Syncrude was designed to capture economies of scale. The first barrel of oil produced by Syncrude was shipped in July 1978, and the plant officially opened a few months later, in September. Then, not two years later, a second project, the Alsands —originally conceived by Shell Canada, Shell Explorer, Amoco, Pacific Petroleum, Chevron Standard, Gulf Canada, Petrofina Canada, and Dome Petroleum— also ran into difficulties. However, in this case, no compromise could be reached. Although both federal and provincial governments were ready to extend a helping hand, the recession of the 1980s, combined with the effects of the NEP and forecasts of a collapse in world oil prices resulted in a decision by the private sector not to pursue this venture any further.

If the story told so far has not shed enough light on Premier Lougheed's multifaceted approach to the development of Alberta's unconventional reserves, the tale of the Alberta Oil Sands Technology and Research Authority (AOSTRA) is sure to dispel any doubts.

[31] Ibid, 120.

# III. The creation of AOSTRA

As his government engaged with the Syncrude consortium on the fiscal and royalty terms, Peter Lougheed realized that although the province of Alberta was the rightful owner of the resource, its bureaucracy was ill-equipped to deal with the complex technical issues related to the sector. Moreover, it became clear to him that without a technological "energy breakthrough" to go alongside the province's direct investment in the sector, success would take decades and might be limited to production from the oil sands mining sector[32].

With characteristic insight, he realized that technology development and capacity building were both long-term propositions. In addition, these efforts would only be truly meaningful if the private sector was intimately involved, so the technology that was developed would meet their needs and could be adopted easily. A quasi-government agency with provincial funding and an independent board of directors would be credible to industry, both from a management as well as a financial perspective. On June 6, 1974 the Lougheed government used a legislative act to set up an arm's-length organization, the Alberta Oil Sands Technology and Research Authority (AOSTRA), with a mandate clearly spelled out[33]. The act also specified that the new institution was to be run by an independent board of directors —no less than three and no more than seven members— appointed by the Lieutenant Governor in Council, and the chairman and vice chairman would be chosen from amongst the appointed members. The agency would report to the provincial legislative assembly through the Minister of Energy (although according to Clem Bowman, the Premier made it clear to all senior civil servants that in case of major problems his office door was open)[34]. To start, Can$100 million (equivalent to Cad$411 million in 2007 dollars)[35] was made available to fund the first five years of operations and projects.

In keeping with the original vision of independence and cohesiveness with the private sector, an international executive search firm was secured to hire the Chairman of the Board. Principal among the firm's requirements was that the individual have extensive industry experience. After a lengthy process, Dr. Clem Bowman, an engineer who had worked for years with Imperial Oil's research labs in Sarnia, Ontario, was appointed AOSTRA's chairman.

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32 Lougheed, Peter. Personall interview, September 2007.

33 From a legal perspective, this was the procedure for agencies that did not reside inside a specific ministry.

34 Salary scales for employees were about 80% of their private sector equivalent, but considerably less for CEO or VP type levels.

35 http://www.bankofcanada.ca/en/rates/inflation_calc.html.

Clem Bowman had an outstanding reputation as an independent investigator that was not afraid to express his opinions, even when those were not in the best interest of the companies he worked for. According to Cedric de Souza, an entrepreneur of long standing, "Clem Bowman was selected because he had worked impressively and successfully on extraction processes for Syncrude for a few years. He knew the technological challenges and had several key papers published. Additionally, his association with Imperial Oil demonstrated his industry knowledge, particularly on in situ production [Imperial pioneered in situ production from their Cold Lake pilot operations]. In short, he had substantial credibility in the oil industry as well as a good business understanding and an engaging personality —a rare combination[36]."

To this day Dr. Bowman, an outstanding innovator, clearly recalls his first interview with Premier Lougheed. Principal among his recollections was the Premier's determination that the industry be part of the new institution; nevertheless Lougheed also insisted that the province of Alberta retain the rights to any technology developed by AOSTRA. The idea was for industry to be able to buy into a particular technology —equal access for a determined value— but for the province, as owner of the resource, to also be the owner of the technologies needed to develop this asset[37].

This was a novel approach. Normally, in such collaborations, industry demanded a stake in the effort, in this case, the ownership of any technology related advances, particularly patents. Dr. Bowman knew it was not going to be an easy sell, however, he understood the vision, and shared its ideals. Unquestionably, much of AOSTRA's success rests on the competence and determination of this quiet engineer who guided the organization through its first ten years, and turned ideas into reality.

That said, there are no doubts that Lougheed's stern hand and vision guided this enterprise. According to Mr. Bowman, "Premier Lougheed was directly involved in the appointment of the first seven AOSTRA Board Members, ensuring a relatively balanced public-private alliance incorporating research, and industrial and strengths. Over the first ten years as retiring Board Members were replaced, oil company presidents and vice-presidents, university presidents, and a number of Members of the Legislative Assembly (MLAs) coalesced as a team on a mission, a mission which never wavered. This was in effect a management board, meeting regularly to lay out strategies and making investment decisions. The Board, especially in the first two years of planning, met extensively with industry, academia and various interest groups to seek consensus on goals[38]." Clem Bowman often mentions how much he admired the role played by the MLAs. He really believes they "left their political tools at the Board room door." Moreover, he noted that not once in his term of office was there a request by any politician to influence a decision of the AOSTRA Board.

Still, it seems that times were different and there was little involvement with NGOs and other special interest groups. Consensus meant a single purpose on an objective and a clear direction on how to get there.

## A. How AOSTRA converted ideas into commercial technologies

For decades, the industry infatuation with Alberta's oil sands had been focused on the huge draglines, trucks and shovels of surface mining projects. With minimum project budgets in the billions, such investments were not for the faint of heart. Actually, this is still the case. By and large, mining projects are reserved for the elite of the oil and gas business —the super majors, national oil companies and the occasional large independent.

But the creators of AOSTRA saw that the future would be much more competitive and technology-rich, with investment shifting towards in situ extraction and project budgets accessible and

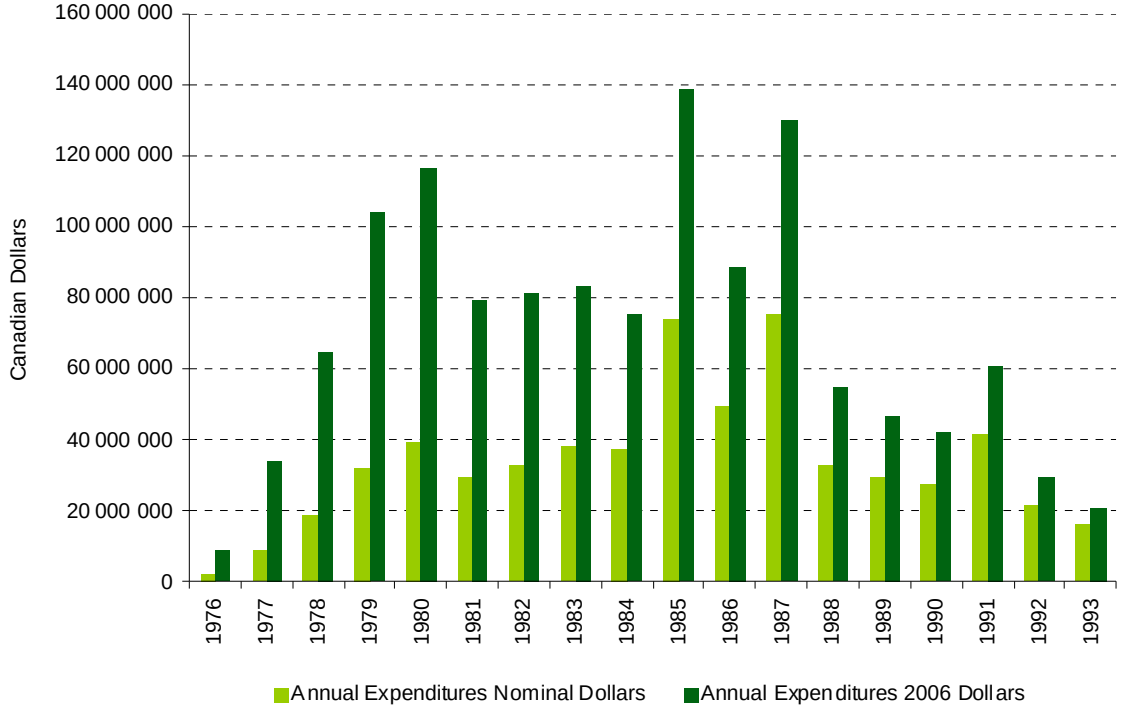
[36] De Souza, Cedric, Personal communications, March 2008.
[37] Bowman, Clem. Personal interview, July 2007.
[38] Bowman, Clem, personal communications April 2008.

affordable for a diversity of smaller oil companies. That is where they concentrated their efforts. Nonetheless, they knew that patience was needed, as widespread commercial applications would be unlikely for two to three decades. In 1977, Clem Bowman suggested to the attendees of the tenth World Energy Conference in Istanbul, Turkey that:

> *Development of Alberta's oil sands will occur at a modest but sustained pace for the next 10-15 years with two or three 17,000*[39] *or so TPCD [tons per calendar day] plants going on stream after Syncrude but before about 1990; and, in the longer term, say from 1995 on, improved technology and reduced world supply of conventional crude oil relative to total world requirements, will likely lead to the development, literally at the maximum rate Alberta is prepared to authorize; this could result in new production of 7000 to 14,000 TPCD each year; it will not be large in a world perspective but it will represent much of the growth in Canada's requirements. (Bowman and Govier, 1977).*

Over the course of 18 years AOSTRA spent Can$448 million (almost Can$1 billion in 2006 dollars) on public-private projects and institutional research (see chart), making AOSTRA one of the largest research and development programs ever launched in Canada[40].

**FIGURE 4**
**AOSTRA ANNUAL INVESTMENTS – 1976 TO 1993**




Source: AOSTRA, 1993.

As the AOSTRA Act specified, the institution's primary focus was the development of one commercial in situ method for each of the oil sands' four distinct areas. The legislation also

[39] Approximately 100,000 barrels per day.
[40] AOSTRA 5 year report.

envisioned the development of more effective and environmentally acceptable upgrading technology, improvements or an alternative to the current surface mining technology and better means of converting bitumen into valued petroleum and mineral products[41].

## B. Governance

The organization's chairman was not the only board member with industry experience; almost all board members had either lengthy industry experience or had recognized scientific and/or academic expertise. In addition, it was mandated that at least one board member was a sitting member of the Alberta legislature. According to Clem Bowman, the presence of a politician served a most important function. This individual was expected to intervene in all discussions in the Alberta legislature where AOSTRA was mentioned, always correcting misconceptions when necessary and ensuring that his/her colleagues were always fully briefed on the organization's ongoing projects.

Although the organization was given initial funding for five years, as with all other government institutions, AOSTRA was subject to annual audits by the provincial Auditor General. Moreover, an annual report was presented to the legislature through the Minister of Energy.

For most of the early years, the organization was run with minimal staff. The Chairman was the only member of the Board to be employed on a full time basis, with technical positions being filled primarily by consultants, and later, by experts seconded from the Alberta Research Council, which was a long established provincial institution with much expertise in oil sands development. Other AOSTRA positions were embedded in companies on special units related to specific projects. The embedded staff were on contract to AOSTRA but paid out of the joint venture. They had defined duties re oversight of the project. Most of the staff also took on specific tasks under the direction of the project manager, in addition to their oversight duties. According to Mr. Bowman's recollection, "they all rose to the challenge of a complex job. There was only one common interest[42]" The staff grew to approximately 30 individuals, mostly embedded as employees, although some were on contract.

The first year, Bowman and his staff proceeded cautiously, meeting with stakeholders from the universities and oil companies to gather their input on the greatest technology needs. "Once the original $100 million in funding was approved by legislation[43] and my appointment was announced, there was a steady stream of people coming to our door. We also initiated meetings with the university presidents and representatives from oil and gas companies," said Bowman. "Out of these discussions, we distilled a plan with detailed objectives." In other words, a medium/long term strategy emerged from this public-private alliance.

In the end, AOSTRA's board of directors settled on two major objectives for its first five years of operation: to work with oil companies to field-test the most advanced technologies developed in their laboratories over the past 20 years; and to harness the university and institutional research capabilities of Canada in the search for new concepts for the recovery and upgrading of bitumen and heavy oils[44].

In late 1975, AOSTRA issued a request for proposals. Twenty one proposals were received and five —requiring Can$235 million in funding— were short-listed. "We discovered $100 million wasn't enough money," said Bowman. "So before really launching, we went back to government and cabinet to ask for an additional $135 million in funding." The government agreed and AOSTRA began negotiating in earnest with industry.

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41 AOSTRA Act, 1974 and Bowman, 1977.

42 Bowman, Clement —email communication— June 2008.

43 Note that Premier Lougheed had a majority government, consequently, approving budgets and legislation was not extremely difficult.

44 AOSTRA, 1980.

"This is when the tough part started," said Bowman. As he noted, "the Alberta government required that AOSTRA own any new technologies developed, a condition that, in the beginning, companies weren't comfortable with." The industry participants let Amoco Canadian Oil Company Ltd. take the lead in the negotiations with AOSTRA. "This wasn't a planned thing," said Bowman. 'The other companies just decided to back off until Amoco cut a deal." And, in the end, industry agreed to the government's demands. "Amoco was really the first company to understand that they didn't need ownership rights, they just needed use rights."

With the Amoco agreement concluded, other companies followed and AOSTRA's projects transitioned quickly from concepts on paper to action in the field. Five projects quickly expanded to ten (see chart) and progress towards Lougheed's grand vision of an energy breakthrough project was underway.

Finally, it should be noted that AOSTRA's only regular evaluation was the annual report to the Legislature, which was highly technical and detailed. In addition, the Chairman of AOSTRA presented annual accomplishment reports to the Executive Council. Nonetheless, although there was no formal independent evaluation by an outside organization, occasional surveys of stakeholders were conducted from time to time. AOSTRA's work also was constantly in the public arena and subject to much public scrutiny. Still, there was much trust as the Board Members of AOSTRA were seen as highly credible and ethical and were constantly involved in self-appraisal.

# C. Joint AOSTRA/Industry funded projects

## 1. In situ projects, the UTF and the evolution of SAGD

From 1976 to 1980, AOSTRA joined forces with industry to fund ten in situ pilot projects. The technology applications were diverse, ranging from fracturing to cyclic steam stimulation (CCS) and combustion processes. Six of the projects focused on the bitumen deposits in the Athabasca, Peace River and Cold Lake regions. The others explored opportunities in the carbonate triangle and heavy oil regions in southern Alberta (see table). For most projects, industry was expected to pay 50 percent of the total project costs, essentially sharing the risk equally with the government.

**TABLE 1**
**AOSTRA FUNDED IN SITU PROJECTS (1976-1980)**

| Location | Participants | Commitment Project Share | Process Investigated | Total Project Cost (Can$ millions) |
|---|---|---|---|---|
| Oil Sands | | | | |
| Athabasca | AOSTRA | 50% | Combustion | 46.0 |
| Gregoire Lake | Amoco Canadian Petroleum Company Ltd. | 12.5% | | |
| | Petro-Canada Exploration Inc. | | | |
| | Shell Canada Resources Ltd. – Shell Explorer Ltd. | 12.5% | | |
| | Suncor Resources | 12.5% | | |
| | | 12.5% | | |
| Athabasca | AOSTRA | 50% | Horizontal | 7.8 |
| Surmont | Gulf Canada Resources Inc. | 50% | wells | |
| Athabasca | AOSTRA | 50% | Fracturing | 2.2 |
| Surmont | Gulf Canada Resources Inc. | 25% | | |
| | Numac Oil & Gas Ltd. | 25% | | |
| Athabasca | AOSTRA | 50% | Shallow sand | 0.2 |
| | Hudson's Bay Oil & Gas Company Ltd. | 50% | process | |
| Peace River | AOSTRA | 50% | Steam | 123.7 |
| | Shell Canada Resources Ltd. | 18.75% | | |
| | Shell Explorer Ltd. | 18.75% | | |
| | Amoco Canadian Petroleum Company Ltd. | 12.5% | | |

(continues)

TABLE 1 (concluded)

| | | | | |
|---|---|---|---|---|
| Cold Lake | AOSTRA | 50% | Steam and combustion | 19.2 |
| | BP Exploration Canada Limited | 20% | | |
| | Hudson's Bay Oil & Gas Company Ltd. | 17.5% | | |
| | Pan Canadian Petroleum Limited | 12.5% | | |
| Carbonates | | | | |
| Buffalo Creek | AOSTRA | 50% | Steam and combustion | 13.9 |
| | Union Oil Company of Canada Limited | 25% | | |
| | Canadian Superior Oil Ltd. | 25% | | |
| Heavy Oil | | | | |
| Suffield | AOSTRA | 50% | Combustion | 9.0 |
| | Alberta Energy Company Ltd. | 25% | | |
| | Musketeer Energy Ltd. | 12.5% | | |
| | Westcoast Petroleum Ltd. | 12.5% | | |
| Viking Kinsella | AOSTRA | 50% | Combustion and steam | 17.7 |
| | Petro-Canada Exploration, Inc. | 50% | | |
| Other | AOSTRA | 10% | Test facility to test well heavy oil lifting technology – note industry had already developed the site and only needed a small amount of funding. | 0.18 |
| | Pengalta Research & Development Ltd. | | | |
| | Nine industry participants | 90% | | |

Source: AOSTRA, 1980.

In terms of new technologies, it is important to note that a technology is not considered developed until it has gone from the initial theoretical formulation, through the commercial testing phase —where the rule of thumb is fifteen to twenty commercial tests (site specific) for every single technology— to the final "acceptance" and usage. This renders investment in research and development a risky proposition. While there are never guarantees that a new idea will actually work, the laboratory phase is perhaps the easiest to fund because the criteria for failure or success are not defined. However, the field tests, which inherently offer no promises of commercially applicable results, are risky and hard to finance. In fact, it is likely that a series of "failures" will precede any eventual "breakthrough" and this, predictably, was the experience of AOSTRA.

Most governments have a hard time facing the political fallout of massive investments that yield no results. However, unlike most governments, the Alberta government of the time appears to have understood and been comfortable with the inherent challenges and long timelines faced by AOSTRA. "Although this program has been in existence only five years, a considerable bank of new technology has been accumulated. However, a full assessment of many of the projects will require several more years of operation and data collection. As in all research, the task is difficult, and new problems are identified as work progresses," wrote Merv Leitch, Minister of Energy and Natural Resources, in 1980[45].

As time passed, and pilot results started rolling in, it became apparent that while the combination of vertical wells and steam stimulation methods worked in some reservoirs, it did not work in the massive deposits in the Athabasca region[46]. As AOSTRA approached its tenth

[45] Ibid.

[46] Cyclic Steam Stimulation (CCS), an extraction process that had been tested in California and Venezuela seemed to work best in reservoirs with good horizontal permeability, like the ones in the Cold Lake region of Alberta. However, they were unsuitable for the Athabasca reservoir characteristics.

anniversary, the only full-scale commercial oil sands operations remained the surface mines. The goal of delivering a commercially viable in situ technology remained elusive.

Focus began to shift towards combining horizontal well and steam technologies. In 1976, AOSTRA and several companies had conducted an economic evaluation of developing oil sands with horizontal wells drilled either from tunnels or by deviation from the surface. While several companies were experimenting with surface drilling, the "horizontal wells" was new, having been piloted in Russia and by ESSO Resources Canada Ltd. (now Imperial Oil) at Cold Lake and perhaps by Mobil before them[47].

From 1979 to 1982, AOSTRA and Gulf Canada Resources Inc. conducted an in-depth feasibility study and engineering design for a shaft and tunnel field pilot. Gulf's Surmont lease, in the Athabasca region, was chosen as a pilot site. Then the bottom dropped out of the oil market, with oil prices suffering significant declines beginning in early 1982, which, combined with the effects of the NEP, resulted in the project stalling. Ultimately, Gulf decided to not to proceed with the field pilot.

Over the next several years, AOSTRA set up a project team, led by Maurice Carrigy, vice-chairman of the board, and hired Norwest Resource Consultants Ltd. to hone the concept of an Underground Test Facility (UTF). This time industry could not be convinced to invest, agreeing only to act as "advisors" to AOSTRA if it decided to proceed.

Bowman believes that industry's reluctance to participate in the UTF was due to global oil market conditions and because technical staff were unfamiliar with the technology. "Gerry Stephenson, president of Norwest and lead researcher on the feasibility study, argued that the oil industry didn't have experience in mining techniques like horizontal drilling and so didn't have the necessary experience to evaluate the potential of the UTF project."

In 1984, AOSTRA decided to go it alone. It announced it would spend Can$ 42 million (later increased to Can$80 million) to build the UTF without industry participation[48]. The Alberta government gave the Authority lease rights to a tract of land 60 kilometres north of Fort McMurray. The UTF was officially opened in 1987 and six years later, AOSTRA announced it was on the verge of a commercial breakthrough with Steam Assisted Gravity Drainage (SAGD)[49]. In fact, SAGD tests were able to recover almost 70 percent of bitumen, an unheard of recovery rate for an in situ project.

The development of in situ bitumen production is a testament to the challenges of moving new technologies along the commercial productive chain. Figure 5 shows all current oil sands production by company, project, and production method. A careful examination shows that, twenty years later, SAGD is still responsible for very little production. However, several facilities are ready to start production in the next few years and the numbers are expected to increase dramatically by the end of 2008. Note that a lag period of 20 to 30 years is not uncommon in technology development and commercialization. These are complex industrial processes with challenges that take time to master.

This technology still earns the province licensing fees (an estimated $1.2 million per company acquiring a SAGD license) but more important than money, it has translated into much data which is shared among industry players. It is important to note that this amount is not enough to cover the province's investment.

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[47] The surface approach utilized slant or vertical wells drilled from the surface. The "shaft and tunnel access approach" employed mining techniques to place personnel and equipment in tunnels burrowed close to, or even within, the bitumen reservoir. Horizontal wells were drilled and completed from these tunnels. In both cases, the reservoir is heated by injecting steam in vertical wells drilled into the pay zone, thereby reducing the viscosity of the bitumen and allowing the oil to flow into the horizontal production wells.

[48] Oilweek, "AOSTRA concentrating on small oil sands projects," Oilweek, January 23, 1984.

[49] Oil and Gas Journal, "Payout Approaches in Alberta's Joint Oil Sands Research," June 8, 1992.

## 2. Mining, upgrading and enhanced oil recovery

While in situ technology was AOSTRA's principal focus, its mandate also included the development of more effective and environmentally acceptable upgrading technology, improvements or an alternative to the current surface mining technology and better means of converting bitumen into valued petroleum and mineral products.

An oil sands surface mine lays a heavy footprint on the environment. Tonnes of overburden — topsoil, muskeg, sand, clay and gravel— must be stripped from the ground to expose the underlying oil sands, a process that is both costly and environmentally damaging due to the disruption of vast tracts of land displaced and the sulphurous nature of bitumen. In the early days of AOSTRA, the only commercial mining extraction process —the Clark Hot Water Extraction Process— produced large quantities of waste solids and water that had to be processed in tailings ponds[50]. Moreover, the Clark process was not amenable to the processing of low-grade oil sands containing low concentrations of bitumen[51].

AOSTRA focused its research efforts on two projects: the Oleophilic Sieve process (in partnership with Suncor) and the Taciuk process. The Oleophilic Sieve process is a method for extracting bitumen from tailings. The Taciuk process is a method for retorting (heating to high temperatures) oil sand that combines recovery and primary upgrading in one vessel. Both of these projects were focused on increasing the efficiency with which bitumen could be extracted from low-grade oil sands. While these projects did have industry participation, they were funded principally by AOSTRA through for-profit research organizations[52].

## 3. AOSTRA/Industry agreements and technology ownership

AOSTRA owned the rights to all technology developed as part of the programs it funded. Industry partners had the right to use new inventions at their own facilities on a non-exclusive license on a free-fee basis. The license included affiliates (at least 50% owner or owned) and was world-wide. In some cases, the intellectual property could be kept confidential from other companies for up to 35 years[53], but AOSTRA had the right to license them either exclusively in Canada or globally depending on the patent, for a "fair market-value" license fee. Fair market value was deemed to be commensurate with what it would have cost the licensee to participate in the development of the technology from the start. Thus, said Dr. Bowman, "…sitting on the sidelines will reap no rewards[54]." While industry was, and remained[55], uncomfortable with the technology ownership rules, the Alberta government saw this as the only way to ensure the public benefited from AOSTRA's investments[56].

Given the results, it seems that the model worked. Prior to 1974, the intellectual property associated with oil sands development was owned predominantly by foreign multinationals, in particular Sun Oil which owned 44 of the 69 oil sands technologies and processes that had been patented in Canada at that time[57]. Eighteen years later, AOSTRA estimated it had produced 15,000 reports and about 116 patents/patent applications/invention disclosures from some 200 projects[58]. Nonetheless, there are some that claim that this IP model was costly, administratively heavy, and hindered development. It is true that many of the patents were abandoned.

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50 Today, tailings ponds at the Suncor and Syncrude mines can be seen in satellite photos taken from space.
51 AOSTRA, 1980.
52 AOSTRA, 1986.
53 Note that these confidentiality agreements have yet to expire.
54 Bowman, C.W. Guest Editorial for Oil Sand Issue of Journal of Canadian Petroleum Technology, March 8, 1977.
55 Luhning, 1994.
56 Hansard, 1974.
57 Chastko, Paul (2004), Developing Alberta's oil sands: from Karl Clark to Kyoto, Calgary, University of Calgary Press 155.
58 AOSTRA, 1999.

Moreover, in later years, successor governments saw technology licensing fees as a means of self-financing for AOSTRA[59] but this was never the early intent. "There was never a thought [AOSTRA] would be self funding in the time I was there," says Bowman. "The concept of getting licensing money was a means to allow companies to come in after projects were initiated." Although there are many views on the exact shape of technology ownership, there is some consensus that government management (as opposed to outright ownership) of these licenses is an efficient system.

## D. Institutional research and inventors assistance program

AOSTRA facilitated research and development by harnessing the intellectual capital of industry, universities and inventors. It did this through the AOSTRA/industry jointly-funded projects mentioned above, but also through the funding of universities and other research organizations and the funding of inventors.

### 1. Institutional Research

AOSTRA committed Can$116 million over 18 years to basic research at universities and other research organizations. This investment significantly raised the level of basic and applied research being conducted at the Alberta Research Council[60] and at Canadian universities.

The projects undertaken by the Alberta Research Council included:

- Oil Sands Research Centre —funding for a variety of basic research on heavy oil and bitumen characteristics, recovery mechanisms and piloting of recovery and upgrading processes.
- Sample Bank —funding to operate a sample bank of several grades of fresh oil sands and bitumen samples.
- Oil Sands Information Centre —funding for a service organization that collected and disseminated information about oil sands and heavy oils.
- Geology Project —funding to conduct regional geological studies in the oil sands, carbonate and heavy oil areas.

In addition to the research undertaken by the Alberta Research Council, AOSTRA also funded many basic research projects at various Canadian universities. It also funded numerous professorships, post doctoral fellowships and scholarships, mainly at universities in Alberta.

AOSTRA's relationship with the federal government was a bit more complex. Although there are many examples of collaboration, such as joint programs with Natural Resource Canada's CANMET (Canada Centre for Mineral and Energy Technology) laboratories, particularly in the field of upgrading technologies, information on those programs is scarce. It appears that the intensely acrimonious relationship between the two levels of government made open institutional collaboration difficult. Thus, it is not surprising that scientists and mid-level managers found it more expeditious to collaborate quietly. Unfortunately, while this served their purpose well, it made the work of future researchers extremely difficult, because there were no detailed records of their collaboration. Moreover, there is reason to believe that these conflicting relations curtail positive spillover effects and negatively impacted the pace of technological development.

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[59] Coopers & Lybrand, 1994.

[60] The ARC was established in 1921 as the Scientific and Industrial Research Council of Alberta (SIRCA) with a mandate to carry out research into the potential of the province's natural resources for industrial development. Nowadays, ARC defines itself as "an applied research and development (R&D) corporation that develops and commercializes technology to grow innovative enterprises." http://www.arc.ab.ca.

### 2. Inventors assistance program

AOSTRA's Inventors Grant Assistance Program provided several hundred thousand dollars a year to inventors with limited means but good ideas. The money was for helping inventors to obtain patent protection for their inventions or to undertake sufficient evaluation work to secure funds for further development from private funding agencies.

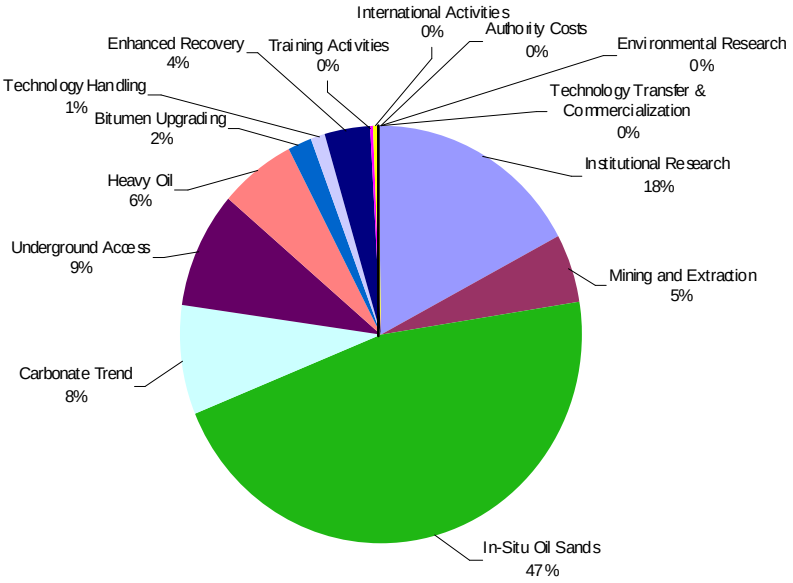
## E. Eighteen years of AOSTRA investment

Most agree that AOSTRA was a success particularly that its investments accelerated the development of oil sands technology and made Alberta a world centre of oil sands research and technology. Over its eighteen years of operation, Can$219 million was invested in situ development, Can$116 million was spent on institutional research and Can$80 million on the Underground Test Facility. Although investments in research in areas other than in situ production technology —which include some 200 projects, 116 patents/patent applications/invention disclosures and thousands of papers— did not yield the same stellar outcomes, success should be measured using results less tangible than patents. For instance, not only did AOSTRA foster an unprecedented collaboration between researchers, industry and government, it also helped educate an entire generation of scientists. And in the age where human capital is as valuable as now, this could be judged as one of AOSTRA's key successes.

Nonetheless, AOSTRA’s structure, leadership, and focus changed with times. After ten years at the helm, Clem Bowman felt he had accomplished his objectives and decided it was time for a change. Not a year later, Peter Lougheed was succeeded in office by Don Getty (1985-1992) and then by Ralph Klein who took over in 1992. Although the AOSTRA leadership that followed Dr. Bowman did continue to pursue the main programs that were in place, it seems that it lacked vision on where to go next. Perhaps, more than anything, this was a reflection of the new government single minded concern with streamlining the bureaucracy, cutting the budget, and balancing the books. A comparison of AOSTRA’s investment by project/sector over its first ten years and second eight years of operation —figures 5 and 6— illustrates this point.

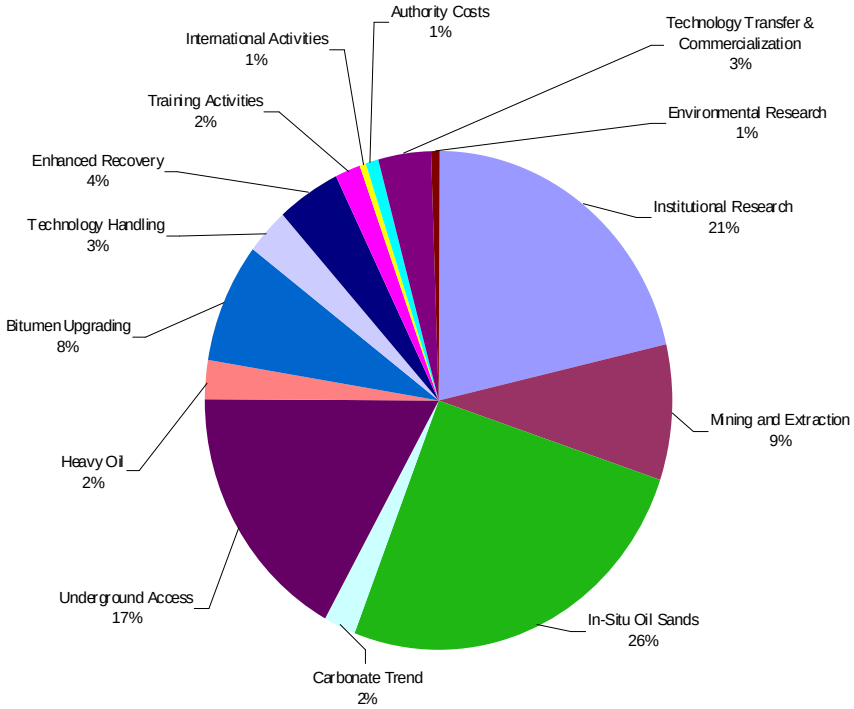
In the first ten years, the organization’s focus on joint AOSTRA/industry in situ projects is clear whereas in the last eight years, there was more of an emphasis on institutional research and the Underground Test Facility. In fact the organization’s leadership had also shifted, from a primarily and singular technical focus on oil sands development, to one that answered to much broader objectives including international partnerships, education, and others. After Clem Bowman left, AOSTRA chairmen were chosen without engaging the services of an international recruiting firm and seemed to have a political agenda. As such AOSTRA had many constituencies to answer to. This was a particular issue given the organization’s quasi-independent legal status combined with its access to substantial funds. In fairness, however, it is worth remembering that the mid-1980s were times of financial hardship for governments. Consequently, pressure for AOSTRA to become self-sufficient increased, something easily noticed by the substantive jump in funding for technology commercialization and handling (see figures 5 and 6).

**FIGURE 5**
**DISTRIBUTION OF AOSTRA INVESTMENTS (1976 TO 1985)**




Source: AOSTRA, 1990.

**FIGURE 6**
**DISTRIBUTION OF AOSTRA INVESTMENTS (1986 TO 1993)**




Source: AOSTRA, 1990.

By the time Premier Klein came to office in 1992, the entire thrust of government had switched from forward vision and economy building to deficit reduction, cuts, and smaller governments. This was not an auspicious time for investments in research and technology development in general, and for AOSTRA in particular. There was political pressure to trim the budget, and more to the point, competition between a politically appointed AOSTRA chairman and the provincial minister of energy.

In 1993, the Alberta Ministry of Energy invited the Coopers & Lybrand Consulting Group to propose a review of its organizational structure. This proposal was presented in November. On February 11, 1994, Patricia Black, Alberta's energy minister, announced a major departmental reorganization aimed at "creating a leaner, more tightly integrated organization that would be better positioned to work with industry while protecting the interests of the people of Alberta, the owners of our energy resources[61]." A new Oil Sands and Research Division as part of Alberta Energy department was created. Not surprisingly, integration between AOSTRA and the new division meant that increasingly funding decisions shifted to the Ministry. By 2000, the entire structure pertaining to research in Alberta had changed. The Alberta Energy Research Institute (AERI) was established on August 1, 2000, by the Alberta Science and Research Authority Act and given the responsibility for all energy-related research for the province. AERI assumed responsibility for the oil and gas research programs previously administered by AOSTRA. It is not our intent to judge the success or failures of AERI —as we did not conduct the research that would allow us to make these assertions. However, we would like to note that although AERI's mandate included working closely with industry, gone was the independence, and more importantly, the long-term funding. As an institute under a ministry, AERI's budget follows the yearly provincial budget funding provisions. Once AERI was establish, its legislation superseded that of AOSTRA, and the organization ceased to exist.

In sum, this is the story of Peter Lougheed's efforts to springboard Alberta resources into a true economic asset for the province. It is a tale of vision, determination, and imperfections. There are many successes, and many elements that worked brilliantly, while others serve as lessons on what not to do. However, before drawing up a list of first principles, there is one issue that deserves special attention: the environment. This is the single element where both Premier Lougheed and Clem Bowman united though their vision was on this issue, were unable to make a difference.

## F. The environment

In early 1973, only one study had been conducted on the environmental impact of oil sands development. Although this issue was not in the public mind, both federal and provincial governments —separately— recommended the creation of research programs. In February 1975, the two levels of government joined forces creating the Alberta Oil Sands Environmental Research Program (AOSERP), with a budget of Cad$4.5 million for one year (Cad$2.5 million from Alberta and Cad$2 million from Ottawa). The main objective of the organization was to examine the impact of oil sands development on the environment of Northern Alberta. Unfortunately, little was accomplished. Three years later, in the midst of the provincial-federal disputes over the price of domestic oil and exports to the US the federal government announced the withdrawal of funds to AOSERP by March 1979[62].

Concurrently, despite a clear legislative emphasis on the environment and awareness by Clem Bowman of the precise environmental challenges that oil sands presented[63], AOSTRA spent less than Can$2 million, or one percent of total funds, on environmental research over the entire 18 years of its operations. In fact, according to the financial accounts, not one dollar was spent on this subject in the

[61] Alberta Energy, The New Structure, May 31, 1995.

[62] Chastko, Paul (2004), Developing Alberta's oil sands: from Karl Clark to Kyoto, Calgary, University of Calgary Press 155.

[63] Bowman, C.W. and G.W. Govier, Status and Challenges in the Recovery of Hydrocarbons from the Oil Sands of Alberta Canada, Contribution to Tenth World Energy Conference, Istanbul, Turkey, September 19-24, 1977.

first ten years. However, Dr. Bowman clarifies that there were field programs devoted to monitoring the environmental impacts, but these initiatives were not entered into the financial ledgers as investments in environmental programs. Specifically, he mentions a clay separation by electrophoresis process designed to deal with the tailing ponds, and two other projects which aimed at eliminating the water problem entirely. And AOSTRA was not alone in the knowledge that water usage, tailing ponds size, stability, and ultimate rehabilitation (as well as natural gas usage) would present significant problems. Industry was well aware of these issues, however, not unlike what we are experiencing now, the belief was that technology —yet to be developed— would come to the rescue. Nonetheless, perhaps this is the only issue where Dr. Bowman mentions regret. "If we had only paid more attention, we would be in a much better position now." But then, he continues, "there was no public awareness at that time, which meant there was no political pressure for anything to happen." It is truly unfortunate, as the vision and leadership should be provided by government and not the public.

Fortunately we now have the benefit of 20/20 hindsight to analyse the events and decisions of a hugely significant era in both resource development and politics in Alberta, and to derive some forward-thinking conclusions and principles that can guide new public/private partnerships in technology development.

## 1. First principals

- Early history of oil sands shows the limitation of free markets in delivering sustained investments in complex, highly capital intensive and challenging situations. Government's ability to define overall goals, judge whether incentives can be provided to the private sector to make the required sustained investments, and then design long terms strategies and policies that will ensure that all the elements needed for development are in place is crucial for long term success.
- Political interference can significantly delay technology development. On the flip side, political vision coupled with significant financial commitment can speed it up. But the vision must be institutionalized in a process of public- private alliances and consensus building if it is to avoid excessive personalization that is vulnerable to political cycles.
- Although, in situations where government is the single source of funding, it is acknowledged that some amount of politicization is inevitable, it is important to design an organization that is arm's-length from government, with long term funding that is- as much as possible - independent of annual budget review processes and electoral cycles.
- Technically competent chairman and board of directors are essential, with the proper checks and balances. Board and chairman should be selected based upon merit, ability to contribute to the goals of the organization and should be willing to provide independent leadership. In order to attract the brightest individuals, these positions should be allocated funds to provide competitive salaries. Moreover, the governance structure should provide for disciplined processes for choosing projects and distributing funds, and ensure that mechanisms exist to ensure embedded employees protect the public purpose.
- In the absence of a visionary leader, the lack of institutional consensus-building capacity and under-representation of stakeholders in the alliance may lead to lack of direction by governments and conflicts with different sectors in society.
- Need to include in the measures of success the human capital, not just the technology developed.
- These types of organizations and/or their programs may have a finite life, commensurate with their mission. Moreover, it maybe useful to build in "sunset clauses" for orderly review of renewal of agency mandates and/or specific support programs.
- Technology ownership or management as well as wide distribution of the same are important parts of the process.

- Uncoordinated interaction between subnational and central governments' strategies and programs can lead to a costs and underexploited opportunities for a region and the nation as a whole.
- Public-private alliance structure is important, but the organization may need the flexibility to go it alone, especially in light of industry's reluctance to try novel ideas that have not been field tested. The return to governments for making the investment must be clearly articulated. However, recovering the full investment made in developing a technology is likely to be an unachievable goal. On the other hand, ensuring that the new technology is readily adopted by industry can be an achievable goal with positive economic and social impacts.
- Failure is a necessary condition to technology development. However, failure can be of a magnitude that is very difficult politically. Consequently, a key to success will be to define goals that are much larger than the technology itself. The development of human capital, the ready adoption of new technology by the business sector, international partnerships that lead to global development and narrowing the gap between developed and developing nations should all be included in the articulation of the ultimate goals of similar institutions and future projects.

To conclude, in an era of uncertainty and therefore risk, development has proceeded beyond expectations in the face of challenging federal and provincial structures and relations, volatile oil prices, primitive technologies, and the massive investment needed to bring oil sands production to markets. Clearly, Peter Lougheed's objectives were achieved. Still we are far from the end of this story.

As we write this chapter, in the late spring of 2008, oil sands production is under attack by environmentalists and even US elected officials. In a May 21st, 2008 US Senate hearing, Illinois senator Richard (Dick) Durban berated oil executives for their intention to solve the supply challenge by investing in the oil sands. According to the senator "because of high prices of oil many companies are looking at many sources they have never considered before, and one of these is Canadian tar sands. You would readily concede this is one of the dirtiest sources of oil that we could be refining, and has environmental concerns which we should all share. When you talk to us about drilling in every direction, in every place and expanding refining capacity for some of the dirtiest crude sources in the world, excuse me, but we also have an environmental and public health responsibility that we have to take into consideration. This should not come down to an equation of your money or your life" [64].

It seems that once again, Alberta is at the crossroads of oil development. As oil sands development proceeds, it seems the time is right to look back at the lessons AOSTRA and Premier Lougheed's leadership offer. Ultimate success will only come if the imagination and ingenuity of Albertans and Canadians is harnessed to ensure production from the oil sands becomes environmentally sustainable.

[64] CBC Radio, The House, May 24th, 2008. http://www.cbc.ca/podcasting/pastpodcasts.html?13#ref13.

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