

CALGARY: CANADA'S ENERGY CAPITAL

ENERGY SECTOR PROFILE



AUGUST 2009

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Calgary Economic Development (CED) is working to make Calgary the undisputed choice for people and business.

As Calgary's lead economic development agency, we work with businesses to facilitate growth, expedite local, national and international business investment and trade development opportunities to promote sustainable economic growth in the Calgary region.

Calgary is Western Canada's business centre and has more head offices per capita than any other Canadian city. Its key economic drivers are Financial Services, Energy, Transportation and Logistics, Information and Communication Technology, Manufacturing, Film and Creative Industries.

CED concentrates its activities on developing these sectors; an experienced economic development professional is dedicated to each sector. Using a hands-on approach, we are furthering the success and growth of existing businesses, helping businesses grow their markets globally and promoting the Calgary Region as the ideal location for business investment.

By working with business and partners proactively and collaboratively, we will be able to achieve higher levels of success for Calgary and the surrounding region.

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ENERGY SECTOR OVERVIEW

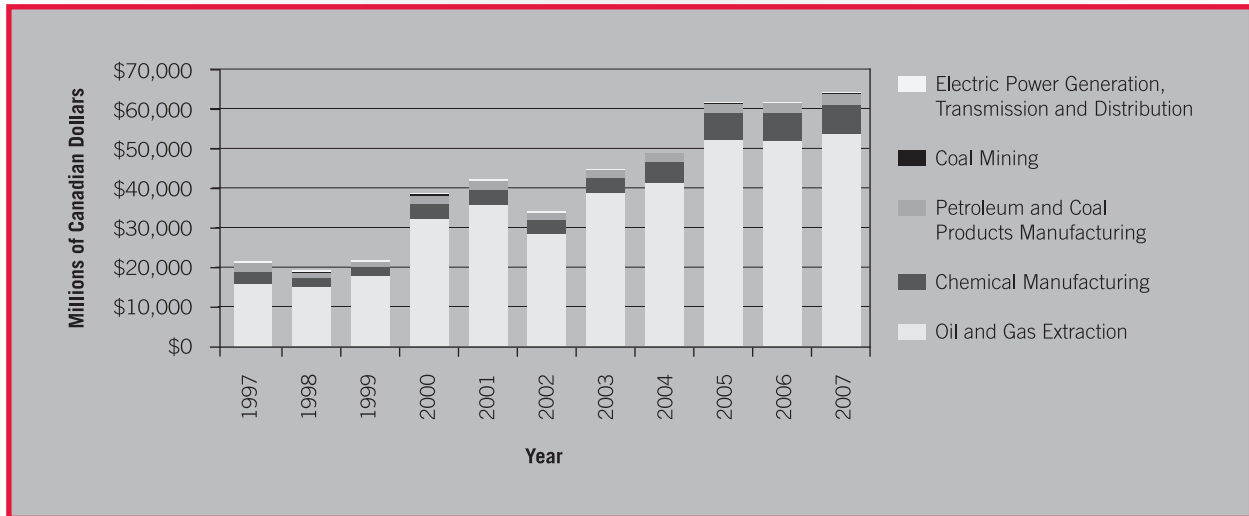
Calgary is Canada's energy capital. It is a city where decisions are made, and deals are brokered. Here you will find the head office of every major oil and gas company in the country, the industry's major trade associations, and the country's energy regulator, National Energy Board. Major pipeline operators and manufacturers, oilfield servicers, drilling companies, energy-related engineering firms, and consulting firms can also be found here. Canada's largest concentration of investor-owned electric power generation companies are based in Calgary, producing power for millions of customers from sources as diverse as coal, natural gas, hydro, biomass and wind. Calgary is also rapidly becoming an innovative national centre for financing, designing, constructing and operating affordable, renewable and environmentally friendly sources of energy.

No other industry in the country is as highly concentrated as Canada's energy sector: the decisions made in downtown Calgary affect multi-billion dollar projects in Alberta, Canada, and around the world. This concentration makes Calgary a global leader in all aspects of energy: project design, exploration, production, finance, processing, transportation, marketing and management.

Some of the best and brightest people in the world have been attracted to Calgary, because of Alberta's economic growth and opportunity. Calgary has the highest concentration of engineers and engineering technologists in Canada. This talented labour force, coupled with world-class research & development and educational institutions, has made Calgary a global hotbed of intellectual talent. Calgary's employment is focused in the financial, scientific, technical, professional, engineering, and high-tech service sectors that serve the energy industry, with much of the city's employment growth focused in professional services.

Calgary's vibrant oil and gas industry is one of the largest in the world. Alberta represents 4.7 per cent of global natural gas production and 10.8 per cent of global natural gas exports.¹ Alberta produces 2.7 per cent of global oil production and 2.9 per cent of global oil exports.² Alberta is a major energy exporter with over \$53 billion in oil and gas exports in 2007.

FIGURE 1 – ALBERTA'S ENERGY EXPORTS, 2007



Source: Industry Canada Trade, Data Online

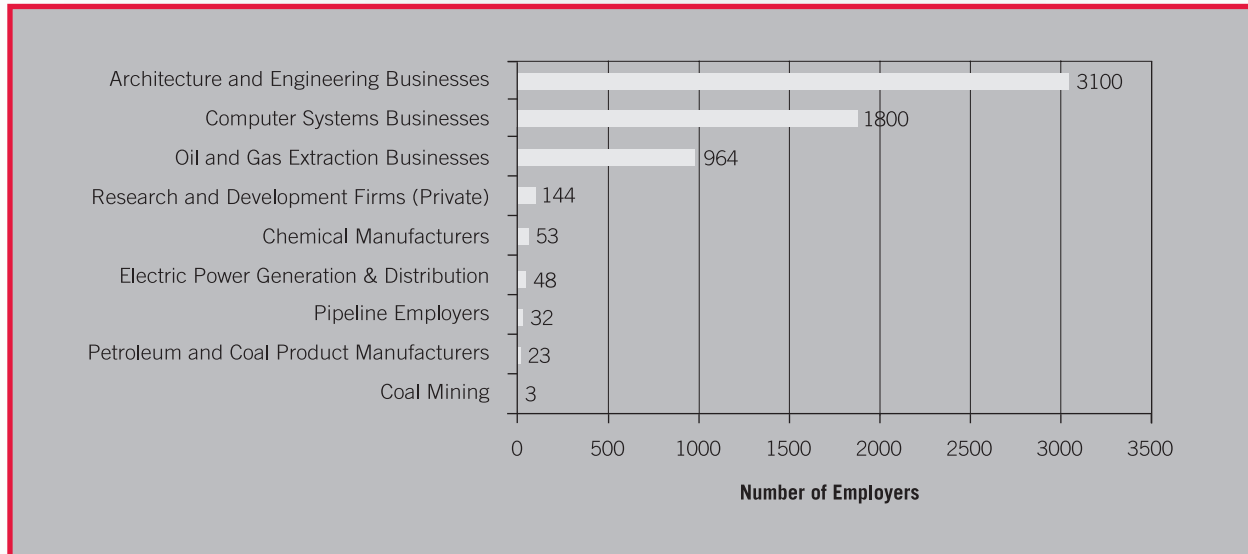
Both oil and gas extraction and chemical manufacturing exports saw staggering growth over the last 10 years, with the former seeing an increase of 220 per cent and the latter growing by 156 per cent.

TABLE 1 – ALBERTA EXPORTS, 1997-2007

Industry (\$MM)	1997	2007	Growth 1997-2007
Oil and Gas Extraction	\$16,644	\$53,334	220%
Chemical Manufacturing	\$2,829	\$7,244	156%
Petroleum and Coal Products Manufacturing	\$2,279	\$2,865	26%
Coal Mining	\$564	\$404	-28%

Source: Statistics Canada, Exports Measures

One of every 13 jobs in Alberta is directly related to energy. According to the Canadian Association of Petroleum Producers (CAPP), almost 147,000 Albertans are employed directly and indirectly by Alberta's mining or oil and gas extraction sectors. Excluding support services for oil and gas mining, Calgary has over 37,000 workers directly employed in the oil and gas industry, 46 per cent of the 81,000-strong Canadian oil and gas labour force. Since 2000, Calgary's oil and gas employment has grown by 51 per cent. Thousands more work in the service sectors that support energy exploration and production.

FIGURE 2 – CALGARY ENERGY EMPLOYERS, 2008

Source: Statistics Canada, Canadian Business Patterns

Investor confidence has resulted in about \$200 billion in planned energy-related investment in Alberta. While investment in Alberta's oil sands has led growth in the energy sector, the sector has diversified with projects planned across a gamut of sub-sectors. For example, Alberta is the Canadian leader in wind energy generation, with over 550 MW of generation capacity.

There are also large investments in pipelines, hydro-power generation, and petrochemicals. The total inventory of major current and planned major projects in Alberta is over \$270 billion for projects over the next eight years.

Total planned (and current) investment in Alberta's oil sands over the next several years is over \$163 billion and investment in 2008 alone is expected to have reached \$20 billion. Every dollar invested in the oil sands generates \$9 worth of economic activity globally, and \$6 of direct and indirect economic activity in Alberta.³ The oil sands are a key driver of the economy in Alberta, accounting for almost a quarter of total investment in the province.

TABLE 2 – INVENTORY OF ALBERTA'S MAJOR PROJECTS, 2008

Project Category	Projects	Value (\$Millions)
Biofuels	17	\$2,009
Chemicals & Petrochemicals	6	\$457
Mining	7	\$2,853
Oil & Gas	10	\$7,882
Oilsands	49	\$163,203
Pipelines	33	\$11,487
Power	46	\$12,410
Total Energy Projects	168	\$200,301
All Other	963	\$69,971
Total	1,048	\$270,727

Source: Alberta Economic Development

TABLE 3 – ALBERTA ROYALTIES BY CATEGORY

Non-Renewable Resource Revenue (in 000s)	2006/07	2007/08F	2008/09F
Natural Gas and By-Products Royalty	\$5,987,697	\$6,023,000	\$5,177,000
Crude Oil Royalty	\$1,399,759	\$1,060,000	\$1,606,000
Synthetic Crude Oil and Bitumen Royalty	\$2,411,430	\$1,795,000	\$2,918,000
Bonuses and Sales of Crown Leases	\$2,462,787	\$1,214,000	\$1,113,000
Rentals and Fees	\$159,319	\$153,000	\$158,000
Coal Royalty	\$12,681	\$15,000	\$14,000

Source: Alberta Finance and Enterprise, 2008 – 2011 Fiscal Plan

Royalties from the oil sands – the share of the revenues for the right to develop the resource – helps to fund many programs and services, including Alberta's infrastructure, health and education systems. Alberta has the lowest provincial taxes in Canada for corporate, small business, and personal taxes. This pro-business environment has promoted strong growth and diversification across Alberta's energy sector.

Royalties paid to the Government of Alberta for development of the province's coal resources amounted to \$14 billion in 2007-08, up from \$9 billion in 2002-03.

OIL & GAS SECTOR OVERVIEW

The oil and gas industry in Alberta is comprised of:

- Conventional oil
- Natural gas
- Oil sands

Rich in natural gas, oil sands and conventional oil, Alberta produces nearly 70 per cent of Canada's crude oil and almost 80 per cent of its natural gas. Close to 80 per cent of total industry spending takes place in Alberta. The Canadian Association of Petroleum Producers (CAPP) estimates that oil production for Western Canada will reach 4.1 million barrels by 2020, which will mean that the region could represent over 5 per cent of global oil production by 2020.

TABLE 4 – ALBERTA OIL AND GAS PRODUCTION & EXPORTS IN GLOBAL CONTEXT, 2008

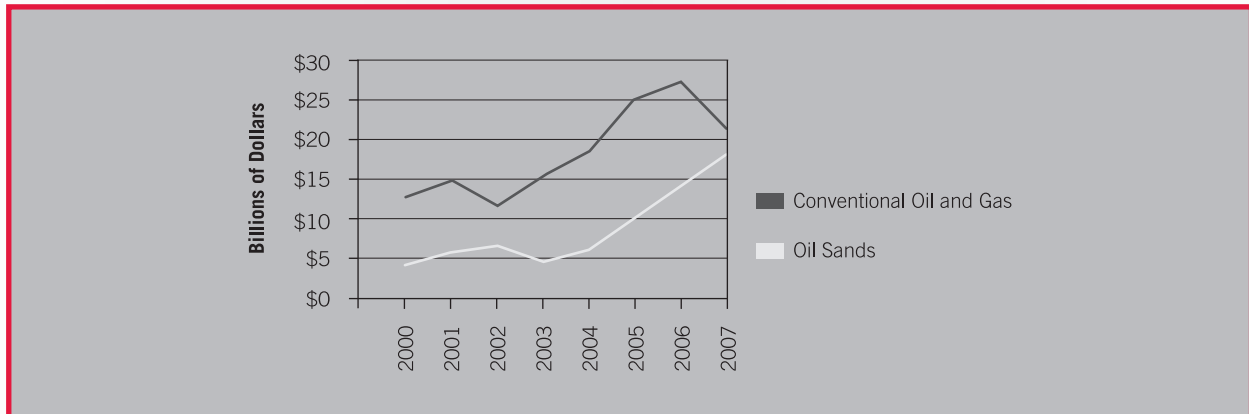
	Alberta	Canada	Alberta Share of Canada	Alberta Share of World
Crude Oil & Equivalent Production	1.89 million barrels per day	2.765 million barrels per day	68%	2.7%
Natural Gas Production	13.1 billion cubic feet per day	16.9 billion cubic feet per day	78%	4.7%
Crude Oil Exports	1.26 million barrels per day	1.824 million barrels per day	69%	2.9%
Natural Gas Exports	9.4 billion cubic feet per day	10.3 billion cubic feet per day	91%	10.8%

Source: CAPP, Alberta Facts and Figures, IEA Key World Energy Statistics 2008

Globally, Alberta is the second largest exporter of natural gas, behind Russia and ahead of Norway, Algeria, the Netherlands, Turkmenistan, Qatar, Indonesia, Malaysia and the United States. Currently, 10.8 per cent of world natural gas exports are from Alberta. The province currently represents 2.7 per cent of world crude oil production and 4.7 per cent of global natural gas production, numbers that will increase as investments in the oil sands continue over the next decade.

In 2007, oil sands investment represented an impressive 46 per cent of total oil and gas investment in Alberta. Investment in oil sands more than tripled over the past eight years from \$4.3 billion in 2000 to \$18.1 billion in 2007.

FIGURE 3 – ALBERTA CAPITAL SPENDING IN CONVENTIONAL OIL & GAS AND OIL SANDS



Source: CAPP, Alberta Facts and Figures

TABLE 5 – ALBERTA CAPITAL SPENDING ON OIL & GAS AND OIL SANDS

Capital Spending (\$ Billions)	2000	2001	2002	2003	2004	2005	2006	2007	Total 2000-2007	Growth 2000-2007
Conventional Oil and Gas	\$12.9	\$14.7	\$11.7	\$15.5	\$18.5	\$24.9	\$27.1	\$21.2	\$146.5	64%
Oil Sands	\$4.3	\$5.9	\$6.7	\$5.0	\$6.2	\$10.4	\$14.3	\$18.1	\$70.9	324%

Source: CAPP, Alberta Facts and Figures

As a result of the activity occurring in Calgary, the city is home to several of the national associations supporting the oil and gas industry:

- The Petroleum Technology Alliance Canada is a Calgary-based not-for-profit association that facilitates collaborative research and technology development to improve the financial, environmental and safety performance of the Canadian hydrocarbon energy industry. PTAC has funded over \$168 million in research and development in Canada’s petroleum industry.
- The Canadian Association of Petroleum Producers is also based in Calgary. CAPP is the voice of Canada’s upstream oil and natural gas industry, representing over 130 member companies.
- The Calgary-based Small Explorers and Producers Association of Canada represents the unique interests of over 450 emerging and junior oil and gas companies, to the public, governments and other sectors of the energy industry.

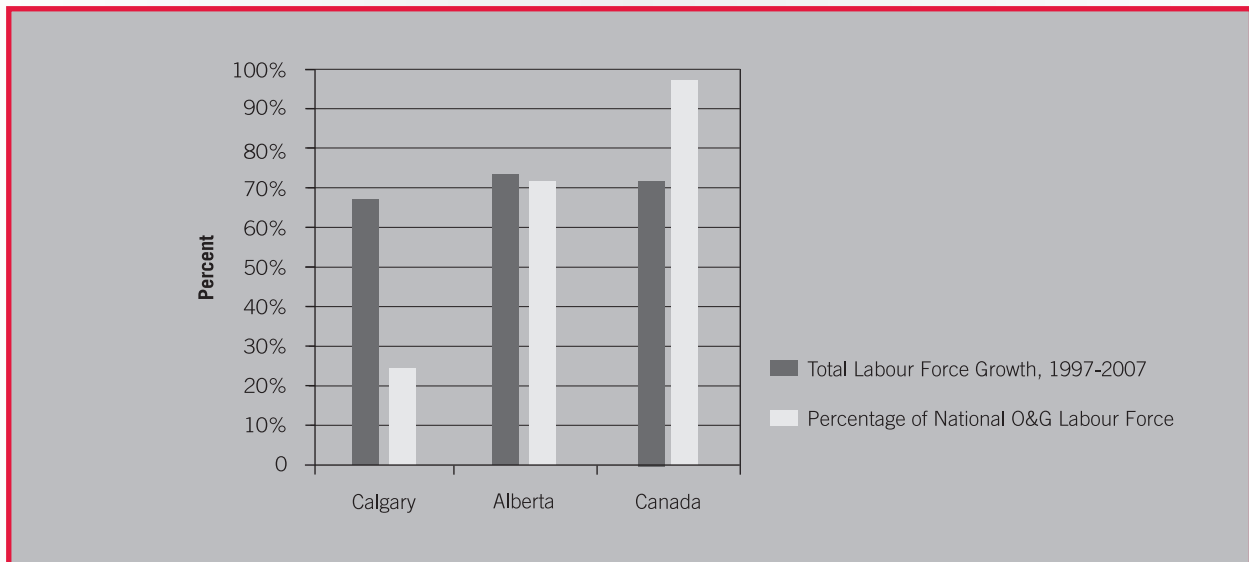
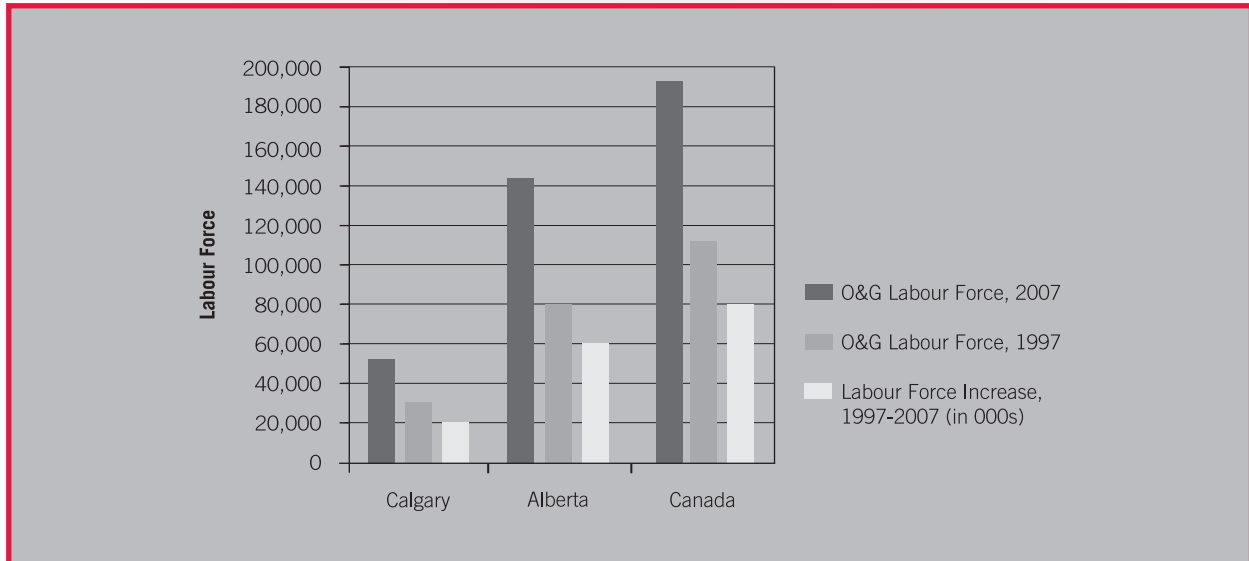
TABLE 6 – KEY OIL & GAS STATISTICS, 2007

2007 Statistics	Market	Alberta	Canada	AB's Share of Canada
Capital Spending:	Conventional (\$ billion):	\$21.20	\$31.70	67%
	Oil Sands (\$ billion):	\$18.10	\$18.10	100%
	Total (\$ billion):	\$39.30	\$49.80	79%
Wells Drilled:	Oil:	1,393	5,202	27%
	Natural Gas:	8,006	9,654	83%
	Total (including dry & service):	16,238	21,210	77%
Reserves (2006):	Conventional (million barrels):	1,664	4,944	34%
	Oil Sands Mining (million barrels):	8,871	8,871	100%
	Oil Sands In-Situ (million barrels):	4,706	4,706	100%
	Natural Gas (trillion cubic feet):	40.2	58.2	69%
Production:	Conventional Oil (barrels per day):	525,000	1,389,000	38%
	Mining – Integrated Synthetic (barrels per day):	545,000	545,000	100%
	Bitumen (barrels per day):	654,000	654,000	100%
	Pentanes Plus/Condensate (barrels per day):	167,000	177,000	94%
	Crude Oil & Equivalent (million barrels per day):	1.89	2.765	68%
	Natural Gas (billion cubic feet per day):	13.1	16.9	78%
Industry Revenues:	Oil, Gas & By-Products (\$ billion):	\$80.40	\$110.50	73%
Royalties/Taxes:	Provincial and Federal (\$ billion):	\$11	\$24	46%
Employment (2006): ⁴	Direct and Indirect:	275,000	365,000	75%
Exports:	Crude Oil (million barrels per day):	1.26	1.824	69%
	Natural Gas (billion cubic feet per day):	9.4	10.3	91%

Source: Compiled by RDA Global

Calgary's oil and gas labour force has grown by 68 per cent over the past decade. Over a quarter (27 per cent) of Canada's oil and gas labour force works in Calgary and 74 per cent work in Alberta. Over the past decade, the industry has added over 21,000 employees in Calgary.

TABLE 7 – KEY LABOUR FORCE STATISTICS FOR OIL & GAS SECTOR



Source: Statistics Canada

TABLE 8 – TOTAL OIL AND GAS EMPLOYMENT, 1997-2007

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Calgary	23,700	22,900	18,300	20,900	24,900	25,100	22,800	24,900	28,800	37,600	37,600
Alberta	45,600	42,500	37,500	39,100	48,000	49,700	49,800	52,800	58,200	66,600	69,900
Canada	55,200	55,300	44,400	45,700	56,800	59,000	58,800	61,800	68,000	78,700	81,000

Source: Statistics Canada

Conventional Oil

Developing the province's conventional oil resources has been part of Alberta life since 1947, when the province's first major oil field was discovered. Since that time, the conventional oil sector has been a perennial driver of the Alberta economy; it remains a part of Alberta's past, present and future.

TABLE 9 – CONVENTIONAL OIL STATISTICS

Conventional Oil	2000	2001	2002	2003	2004	2005	2006	2007
Wells Drilled	2,297	1,895	1,707	2,042	1,847	1,949	2,146	1,393
Reserves at Year End (million b/d)	2,079	1,947	1,921	1,753	1,741	1,704	1,664	N/A
Production (thousand b/d)	748	720	661	629	600	571	543	525

Source: Alberta Energy

In 2007, Alberta Energy reported conventional crude oil production made up about 27.7 per cent of Alberta's total crude oil and equivalent production, equal to 19 per cent of Canada's total crude oil and equivalent production.

Development of Alberta's conventional oil industry has created an extensive infrastructure, supporting the continued drive to locate, drill for, and transport oil to market. This infrastructure continues to grow: CAPP reports that between 2000 and 2007, industry invested more than \$146 billion in the province's conventional oil and gas industry.

Industry also continues to focus on finding innovative and more efficient ways to extract a higher percentage of crude oil from conventional reservoirs, recognizing that up to 70 per cent of total crude oil reserves in Western Canada cannot be extracted with existing technologies. As conventional oil production and reserves are declining, Alberta continues to invest in oil and gas R&D and the educational institutions that support it.

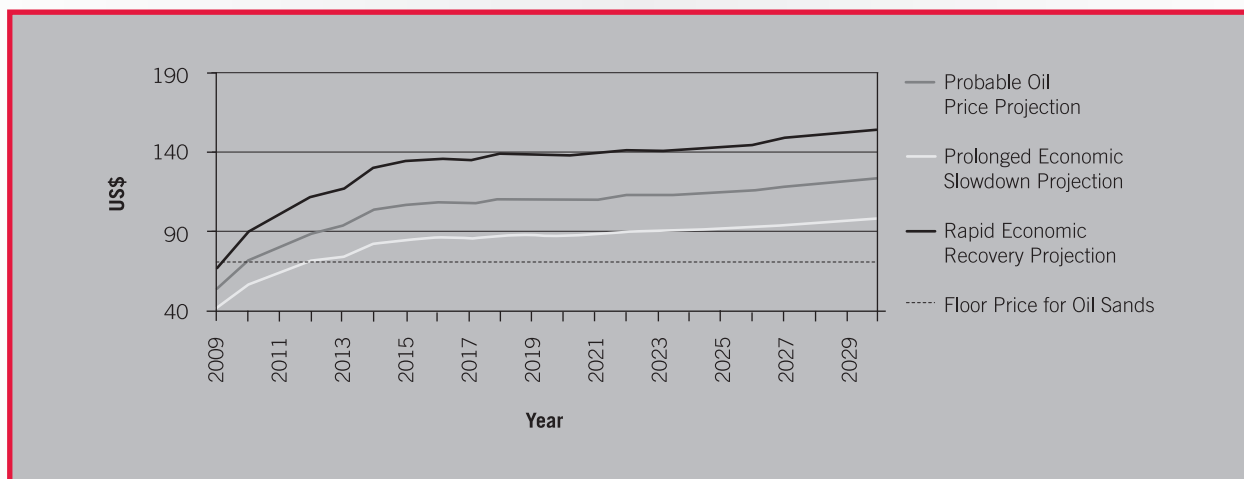
TABLE 10 – ALBERTA CONVENTIONAL OIL RESERVES, 2007

Conventional Oil Reserves	Billion Barrels
Initial Volume in Place	66.3
Initial Established	17.3
Cumulative Production	15.8
Remaining Established	1.5
Initial Ultimate Potential	19.7
Remaining Ultimate Potential	3.9

Source: Energy Resource Conservation Board

Most of the crude oil produced in Alberta is exported to other markets. Of the production that remains in the province, most is converted into transportation fuels at refineries in Alberta. A much smaller portion is refined into other oil-based products such as lubricants, waxes, plastics, synthetic rubber and asphalt, or used to generate electricity, heating homes and other buildings.

FIGURE 4 – LONG TERM OIL PRICE PROJECTIONS, US\$/bbl WTI EQUIVALENT

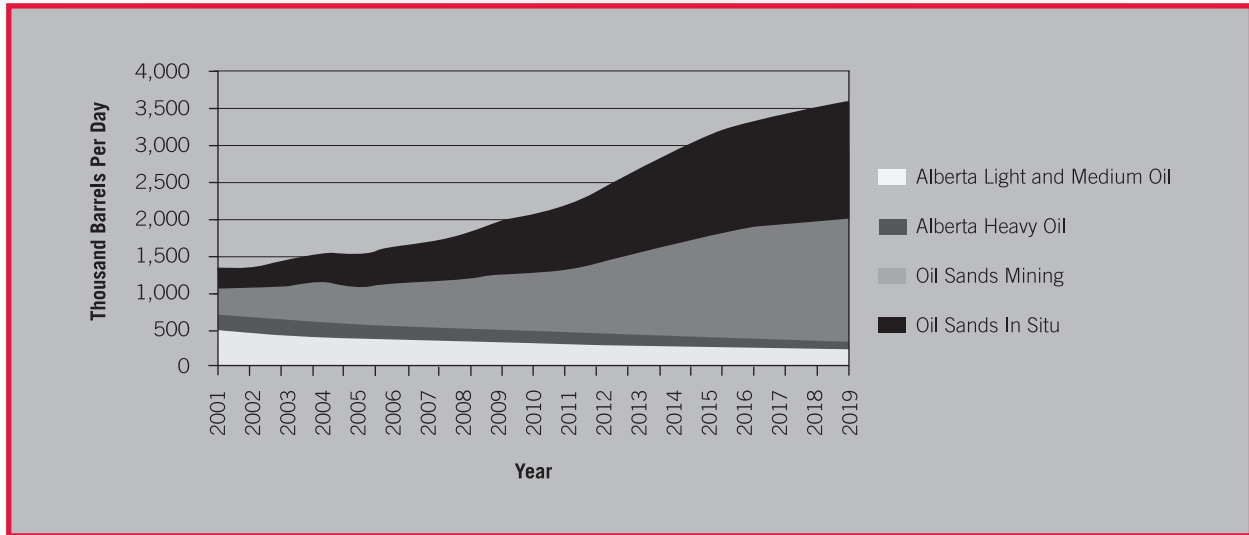


Source: David McColl, Senior Economist for Canadian Energy Research Institute, February 2009

Oil Sands

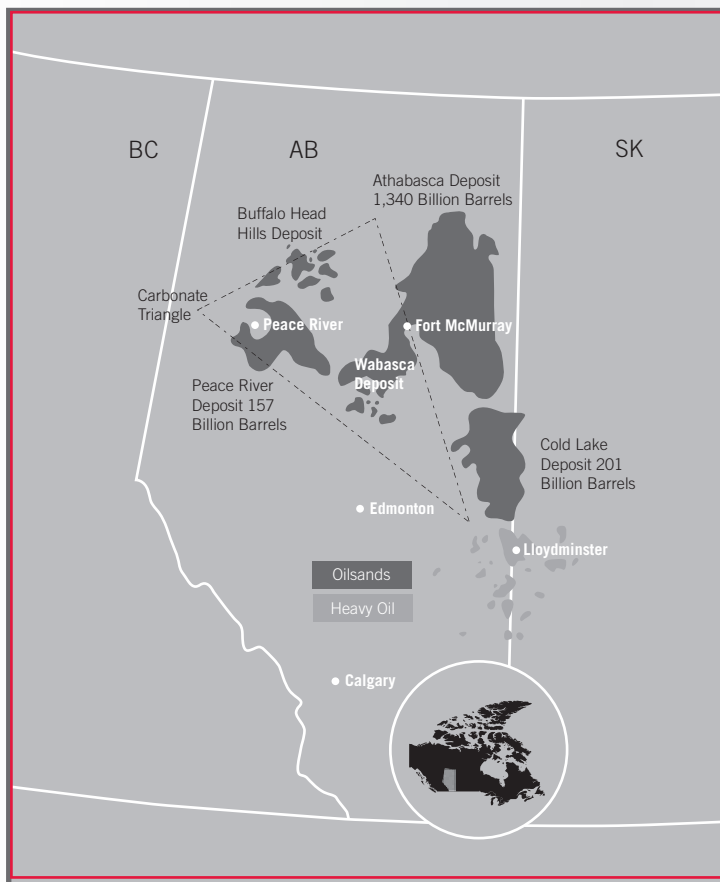
Oil sands are deposits of bitumen, a low-viscosity oil that will not flow unless heated or diluted with lighter hydrocarbons. Alberta’s oil sands are the world’s largest deposits of oil and are contained in three major areas beneath 140,800 square kilometres of Northeastern Alberta – an area larger than the state of Florida and twice the size of Ireland.

FIGURE 5 – CAPP CRUDE OIL PRODUCTION FORECAST FOR ALBERTA



Source: Canadian Association of Petroleum Producers

MAP 1 – ALBERTA'S OIL SANDS



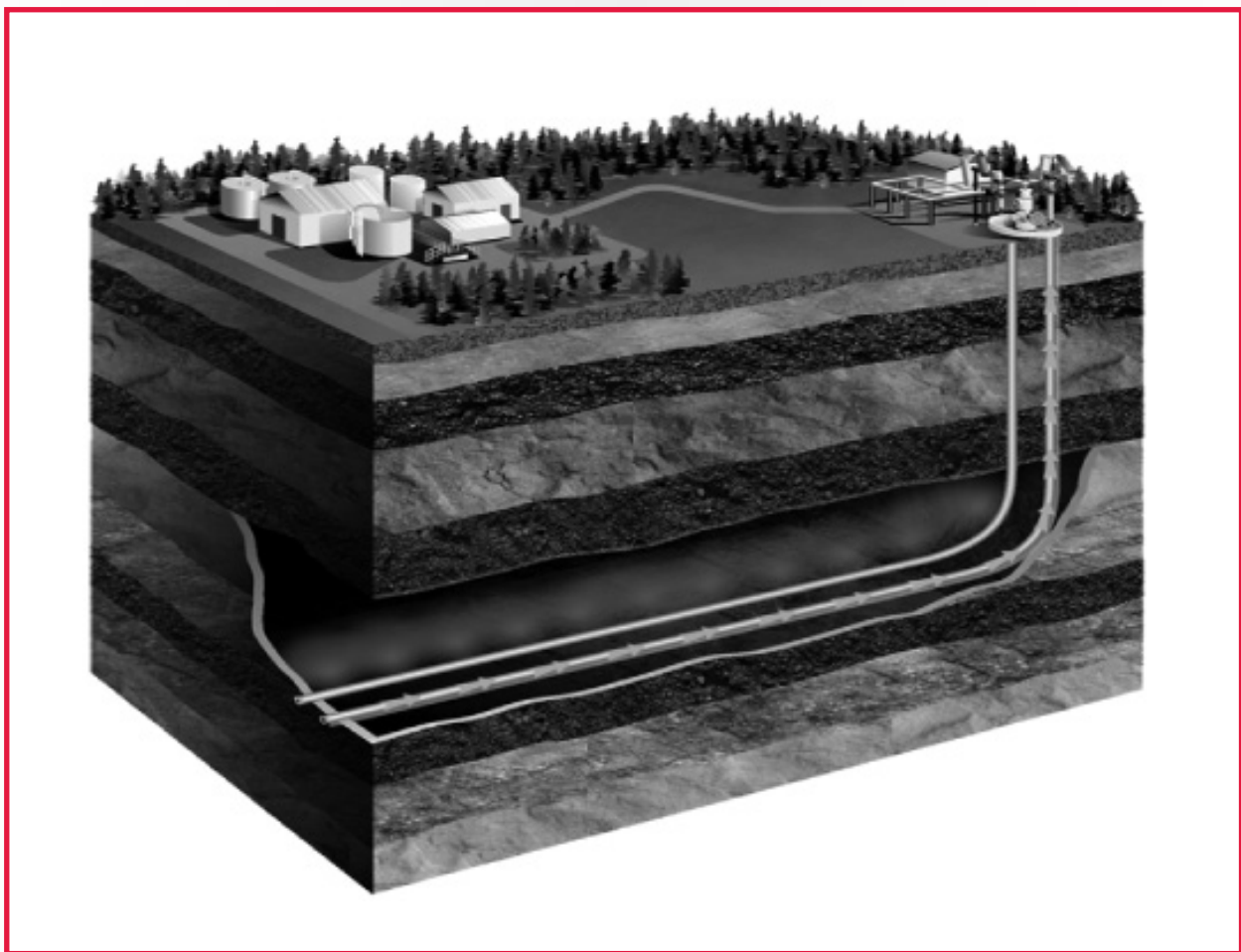
Source: Centre for Energy

These deposits contain one-third of the world's known oil reserves. The oil sands have an estimated 1.7 trillion barrels of oil in place – enough to supply the world's total needs for up to 15 years. Of this, 172.7 billion barrels are recoverable (as of 2007) with current technology. There are several active oil sands projects in Alberta. Of these, three are mining projects; the remaining projects use various in situ (in place) recovery methods.

In **mining** recovery methods, large areas of land are cleared of trees and brush, then the top soil and clay are removed to expose the oil sand. This surface mining method uses large trucks and shovels to remove the sand, which can have a volume of anywhere from 1-20 per cent of actual bitumen. After processing and upgrading, the end result is sent to refineries.

In Situ is a relatively new method and is mainly used to get bitumen in oil sand that is buried too deep below the earth's surface to be recovered with a truck and shovel. In situ technology injects steam deep beneath the earth to separate the viscous bitumen from the sand and pump it up to the surface. The bitumen then goes through the same upgrading process as it would in the mining method. The in situ method is more costly than the mining method, but it's much less damaging to the environment, requiring only a few hundred meters of land and a nearby water source to operate. It's estimated by the Alberta government that 70-80 per cent of oil in the oil sands is buried too deep for open pit mining; therefore, in situ methods will likely be the future of extracting oil from oil sands. The most common form of in situ is called Steam Assisted Gravity Drainage (SAGD).

FIGURE 6 – STEAM ASSISTED GRAVITY DRAINAGE (SAGD)

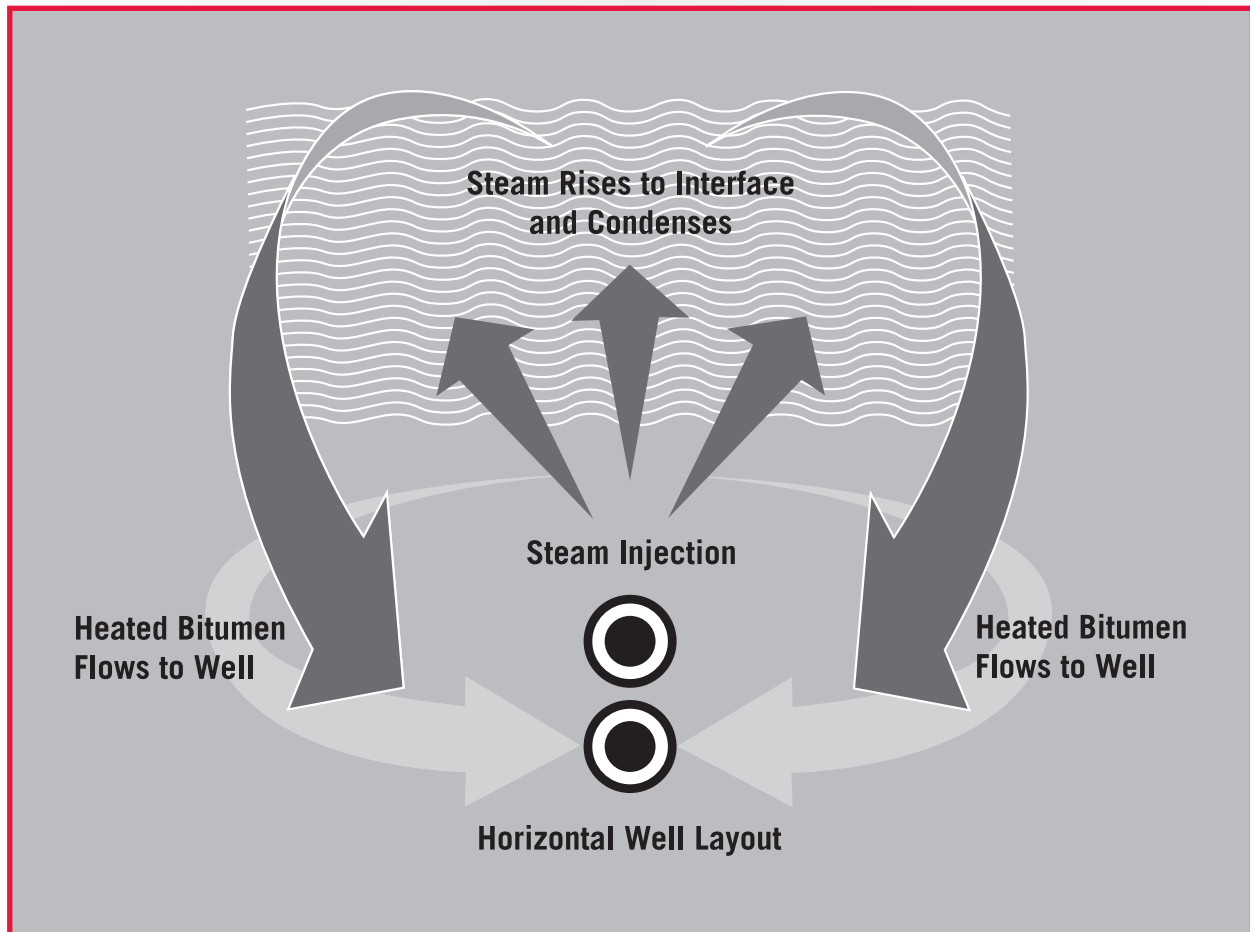


Source: BlackRock September 2005, courtesy of Canadian Energy Research Institute

SAGD allows bitumen to be recovered from oil sands deposits that are impractical for surface mining and extraction methods. Only five per cent of oil sands can be recovered through surface mining, while other in situ extraction techniques recover around another 15 per cent. The development of SAGD has the potential to double the economic viability of oil sands reserves.

SAGD was developed between 1986 and 1998, and is the result of collaboration between the Government of Alberta, Alberta Oil Sands Technology and Research Authority, and industry partners. It was first pilot-tested at an underground test facility near Fort McMurray, Alberta. In 1999-2000, a number of the original development partners were licensed to use SAGD technology and announced commercial ventures worth a total of over \$3.4 billion.

FIGURE 7 – HOW SAGD WORKS



Source: Husky Energy Sunrise Project Application August 2004, courtesy of Canadian Energy Research Institute

In 2007, Alberta's oil sands produced 1.2 million barrels of oil per day and were the source of about 43.7 per cent of all crude oil and equivalent produced in Canada. However, only 3.3 per cent of the established resource has been produced to date.

TABLE 11 – ALBERTA OIL SANDS RESERVES, 2007

Oil Sands Reserves (2007)	Billion Barrels
Initial Volume in Place	1,712
Initial Established	178.7
Cumulative Production ⁵	5.9
Remaining Established	172.7
Initial Ultimate Potential	315
Remaining Ultimate Potential	309.1

Source: Energy Resource Conservation Board

Annual oil sands production is growing steadily as the industry matures. CAPP expects oil sands production to grow from 1.2 million barrels per day in 2007 to 3.3 million barrels per day in 2020.

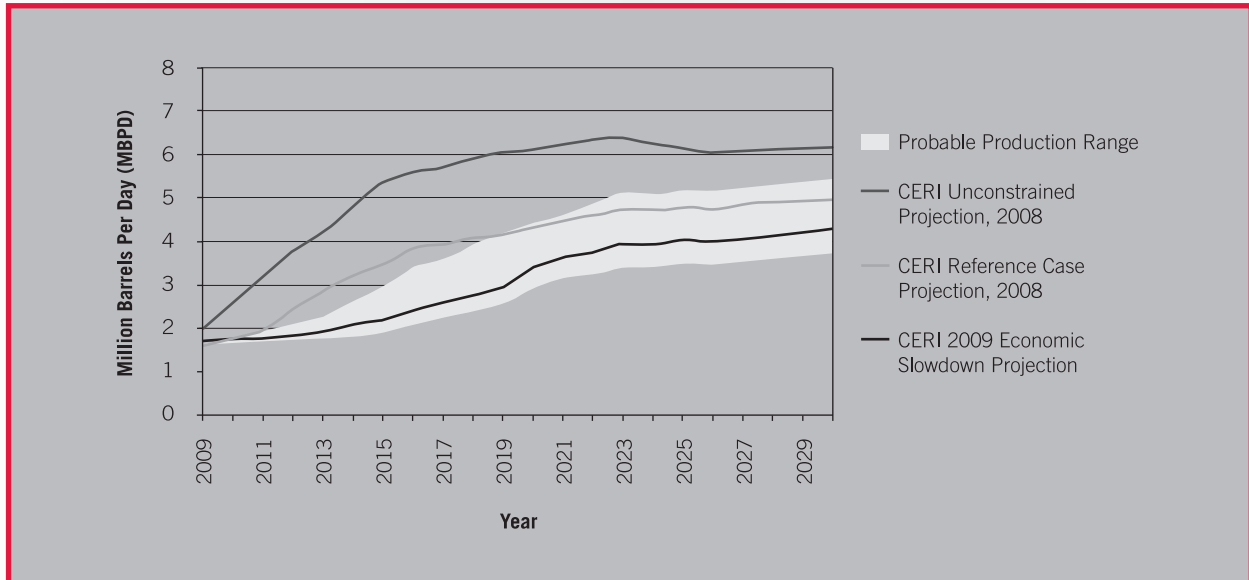
Calgary's energy sector has been instrumental in turning "theory into reality" through capital investment, research and technological innovation. Industry investment in the oil sands has grown from \$4.3 billion in 2000 to \$18.1 billion in 2007, a total of \$70.1 billion over the period. It is estimated that over \$20 billion of investment occurred in 2008 and there is over \$163 billion in investment in major projects that has been planned, announced or currently under construction over the next eight years.

As well, government and industry have worked together to find innovative and economical ways to extract and process the oil sands. In particular, the Alberta Energy Research Institute (AERI) helps spur new technology and innovation programs that will reduce the impact of greenhouse gases and other emissions, and reduce the consumption of water and gas.

AERI research priorities include:

- Bitumen Upgrading – improving product quality and identifying new business opportunities while reducing environmental impacts, increasing profitability, and lowering capital costs.
- Improved Recovery – developing key recovery technologies to achieve production and reserves targets for both conventional and unconventional resources while minimizing environmental impacts.

FIGURE 8 – ALBERTA BITUMEN PRODUCTION CAPACITY



Source: David McColl, Senior Economist, Canadian Energy Research Institute

Natural Gas

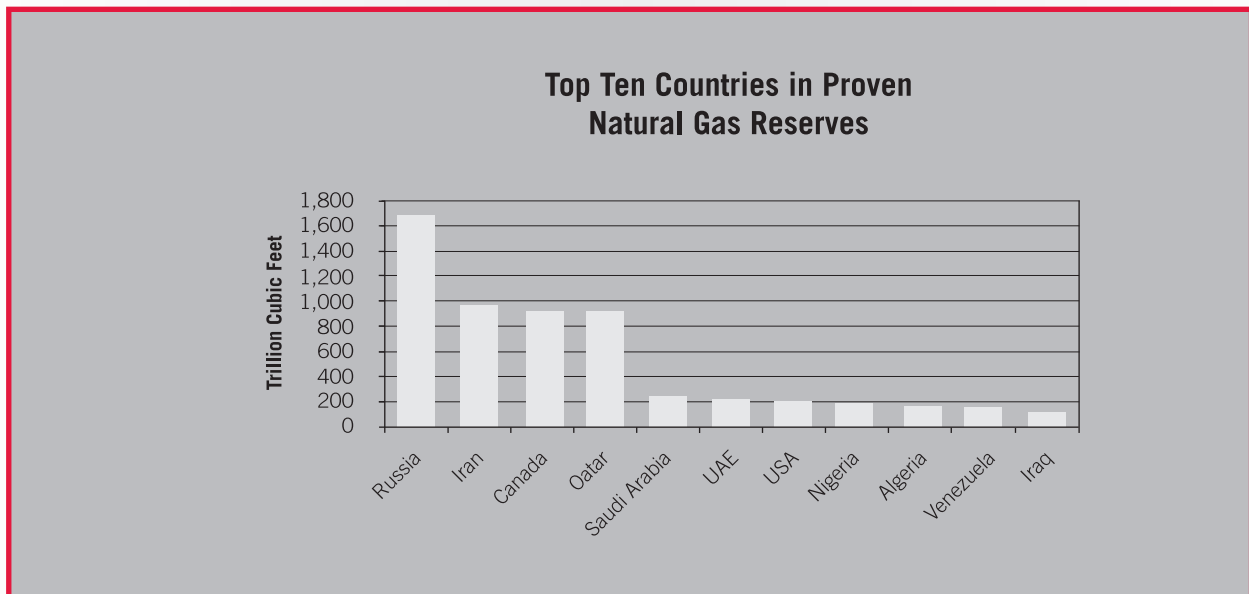
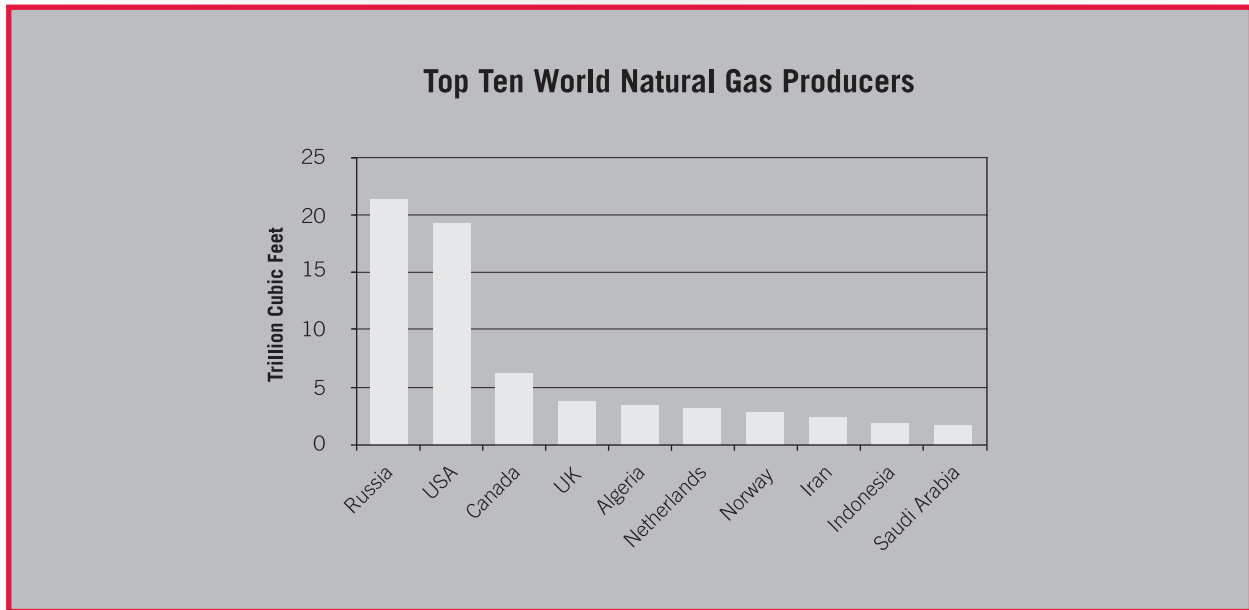
Natural gas is one of the cleanest, cheapest and most efficient sources of energy. Alberta is home to a large natural gas resource base and accounts for just over 80 per cent of the natural gas produced in Canada.

TABLE 12 – ALBERTA NATURAL GAS STATISTICS

Natural Gas	2000	2001	2002	2003	2004	2005	2006	2007
Wells Drilled	7,353	8,789	6,949	9,942	12,276	13,268	11,603	8,006
Reserves at Year End (trillion cubic feet)	44.8	45.2	44.5	42.5	41.7	40.9	40.2	N/A
Production (billion cubic feet per day)	13.8	13.6	13.4	13.0	13.1	13.2	13.2	13.1

Source: Canadian Association of Petroleum Producers

FIGURE 9 – TOP TEN COUNTRIES FOR NATURAL GAS PRODUCTION AND RESERVES



Source: Oil and Gas Journal, US Department of Energy (Note: Canadian reserves include coalbed methane reserves)

Alberta's total reserves of natural gas are 917 trillion cubic feet, including conventional natural gas reserves and coalbed methane reserves. Of this, Alberta Energy estimates the province's recoverable, conventional natural gas to be 40.5 trillion cubic feet (Tcf).

With new technology, Calgary companies are exploring opportunities to optimize the extraction of natural gas from coal while maintaining appropriate environmental controls.

TABLE 13 – ALBERTA NATURAL GAS RESERVES, 2007

Natural Gas	Trillions of Cubic Feet
Initial Volume in Place	321
Initial Established	182
Cumulative Production	141
Remaining Established	40.5
Ultimate Potential (recoverable)	232
Remaining Ultimate Potential	91

Source: Energy Resource Conservation Board

Coalbed Methane (CBM) reserves have been recognized as a commercial supply of natural gas in Alberta since 2002. Activity in CBM has increased dramatically from a few test wells in 2001, to over 9,000 wells producing CBM in 2007.⁶ The growth in CBM data collection and gas production has increased confidence in publication of CBM reserves estimates, despite continued uncertainty in recovery factors and production accounting. The current established reserves of CBM in Alberta are estimated to be over 500 trillion cubic feet.

In addition to heating homes and businesses, over 60 per cent of the natural gas consumed in Alberta is used by the industrial sector. Natural gas is an important raw material for the province's oil sands and electric power generation industries, which have seen tremendous expansion over the past decade.

Petrochemicals

Petrochemical production is one of the largest manufacturing industries in Alberta, accounting for more than \$15.5 billion worth of products annually, of which \$7.1 billion is exported. The industry directly employs more than 7,700 Albertans. Alberta is Canada's leading petrochemicals manufacturer and home to four petrochemical plants with a combined annual production capacity of 8.6 billion pounds of ethylene. Two of those plants – at Joffre and Fort Saskatchewan – are among the world's largest.

The current viability of the province's petrochemical industry is based on access to a long-term, secure and economic supply of [liquified natural gas] (LNG) feedstock – particularly ethane – and the ability to develop suitable competitively priced products for international markets. As conventional gas production declines, less ethane will be available for use by the petrochemical sector. In response to the forecasted decline in economically recoverable ethane, tightness in the ethane supply and demand balance in Alberta, the provincial government implemented a new policy that will provide incentives for value-added production and the use of ethane in the province.

TABLE 14 – PETROCHEMICAL STATISTICS, 2007

Alberta Statistics	
Production Capacity	8.6 billion pounds per year
Value	\$15.5 billion in products shipped
Exports	\$7.1 billion
Provincial Employment	7,700 employees
Investment	over \$10 billion from 1974-2007

Source: Alberta Energy

TABLE 15 – ETHYLENE PRODUCTION, 2007

	Metric Tonnes (in 000s)
Alberta	4,300
Canada	5,095
World	76,537

Source: Alberta Energy, EIA

The Incremental Ethane Extraction Policy (IEEP), first announced in September 2006, is a ten-year initiative to encourage increased production of ethane extraction from natural gas and from gases produced as by-products of bitumen upgrading. Off-gases are a mixture of hydrogen and light gases, including ethane, ethylene, and other light hydrocarbons. The majority of the off-gases produced from oil sands upgraders are presently being used as fuel for oil sands operations. It is estimated that with new refining, capacity up to 150,000 barrels of ethane could be produced from bitumen upgrading and used for petrochemical feedstock. IEEP provides royalty credits to encourage petrochemical companies to significantly increase the amount of ethane they consume compared to historical levels.

TABLE 16 CHEMICAL MANUFACTURING EMPLOYMENT, 1997-2007

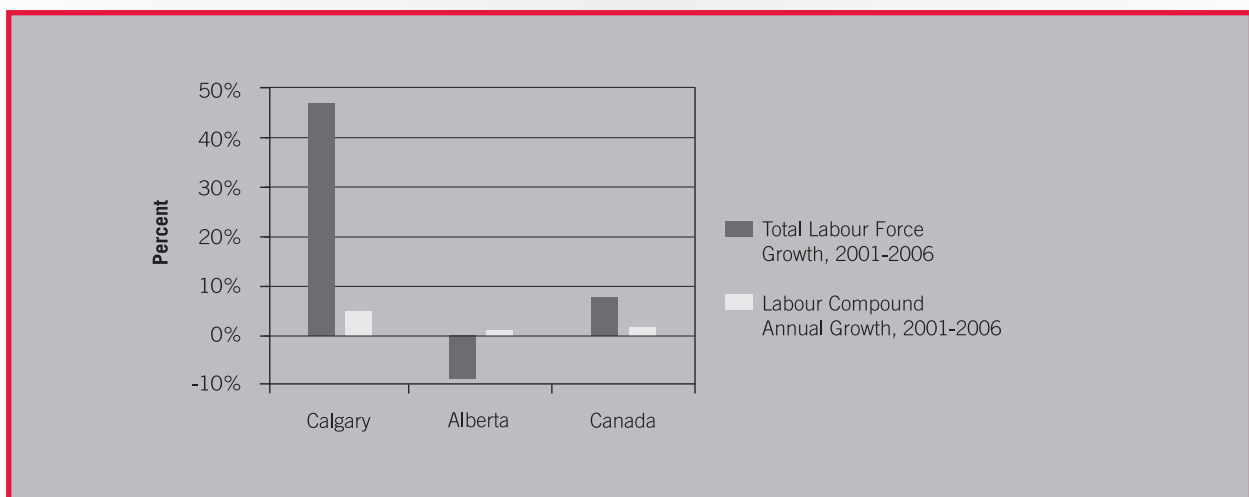
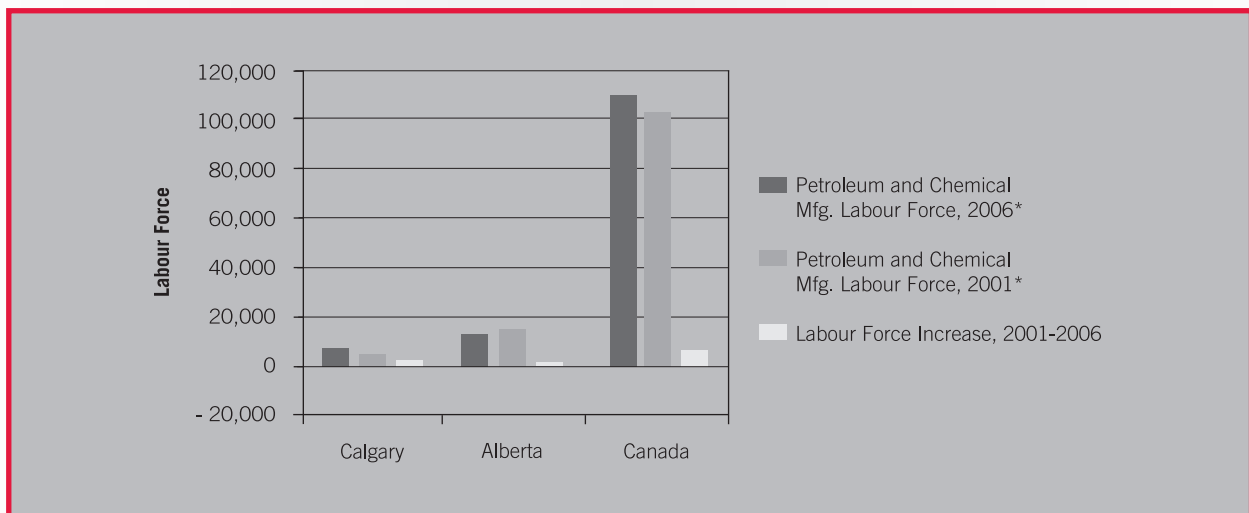
Chemical Manufacturing Employment	1997	2002	2007	Growth 1997-02	Growth 2002-07
Calgary	2,200	1,800	2,700	-18%	50%
Alberta	9,000	9,800	8,900	9%	-9%
Canada	99,300	125,000	108,400	26%	-13%

Source: Statistics Canada

The chemical manufacturing industry in Calgary produces petrochemicals, fertilizer, plastics, rubber products, polystyrene foam products, paints and a variety of other chemical products. Over the past decade, employment in Alberta's chemical manufacturing sector has been stable, with approximately 9,000 employees. Over the past five years, that industry's employment concentration in Calgary has grown by 50 per cent from 1,800 employees in 2002, to 2,700 in 2007.

Petroleum and chemical manufacturing combined represent a 4,900-worker labour force in Calgary, which accounts for four per cent of national employment in the industry. Calgary's labour force in petroleum and chemical manufacturing grew by 48 per cent from 2001 to 2006, far above the national growth rate of nine per cent.

TABLE 17 – KEY LABOUR FORCE STATISTICS FOR PETROCHEMICALS



Source: Statistics Canada

* Note: Includes petroleum, coal products manufacturing and chemical manufacturing; petroleum manufacturing data unavailable for 2007.

Pipeline

In 2007, Alberta's pipeline infrastructure was made up of 403,544 kilometres of crude oil, natural gas and other pipelines. Calgary is the decision-making headquarters for a number of large North American pipeline companies and home to the Canadian Energy Pipeline Association (CEPA).

CEPA reports that its members deliver about 16.3 billion cubic feet of natural gas, including 6.3 billion cubic feet per day, to Canadian markets and 10.4 billion cubic feet per day to U.S. markets. The value of this exported natural gas was approximately \$27.8 billion in 2007. Oil pipelines transport approximately 2.72 million barrels of liquid hydrocarbons every day, 870,000 barrels to Canadian markets and 1.85 million barrels to US markets. The value of exported crude oil was approximately \$41.2 billion in 2007.

The Albertan network of operating pipelines links major production areas, markets, and export terminals throughout North America. The development of new export pipelines and expansions (to join with existing pipelines to the U.S.) has allowed Alberta gas to be fully integrated into the North American gas marketplace.

About 50 per cent of Canada's pipeline labour force is based in Calgary, and 73 per cent is based in Alberta.

Western Canadian crude oil pipelines are reaching the limits of their capacity and therefore additional capacity is required. Approximately 1.1 million barrels per day of new pipeline capacity is being added before the end of 2010, which should be sufficient until 2013. Subsequently, a significant amount of additional pipeline capacity will be required to meet expected oil sands growth. There are numerous pipeline proposals to new markets such as the U.S. Gulf Coast and East Coast which reflect the significant increases in heavy and light synthetic crude oil supply.

There is currently \$11.6 billion of investment proposed and under construction in Alberta. There are a large number of, either direct or indirect, pipeline proposals to the U.S. Gulf Coast market. This reflects the availability of heavy crude oil conversion capacity in this market as well as projected growth in heavy crude oil supply from Western Canada.

TABLE 18 – ALBERTA PIPELINE OPERATORS

Pipeline Operator	Description	Specifications
Alliance Pipeline L.P.	The Alliance Pipeline system carries natural gas and NGLs from Northeastern British Columbia and Northwestern Alberta through Saskatchewan, North Dakota, Minnesota, and Iowa to its terminus in Illinois.	Canada: 1,560 km (970 miles) of 914-mm to 1067-mm (36-inch to 42-inch) diameter steel pipe; 731 km (454 miles) of laterals United States: 1429 km (888 miles) of 914-mm (36-inch) diameter steel pipe.
ATCO Pipelines	The ATCO system connects natural gas producers within Alberta markets and provides interconnections with all major pipeline systems that move gas out of the province.	More than 8,400 km (5,219 miles) in Canada. 35,372 km (22,000 miles) distribution system.
Enbridge Pipelines Inc.	Enbridge Pipelines carry liquids (75 unique commodity types) from point of supply in Western Canada to refining markets in the Midwestern United States and Eastern Canada.	13,500 km (8,500 miles) of 305-mm to 1219-mm (12-inch to 48-inch) diameter pipe.
Foothills Pipeline Ltd. (100% owned by TransCanada PipeLines Ltd.)	The Western Leg of the Foothills Pipeline transports natural gas from south of Caroline, Alberta along the foothills of the Rocky Mountains and through the Crowsnest Pass to Kingsgate, British Columbia, where it interconnects with Gas Transmission Northwest Group. Natural gas transported through the Western Leg is delivered to California and the Pacific Northwest.	290 km (180 miles) of 914-mm and 1067-mm (36-inch and 42-inch) pipeline.
	The Eastern Leg transports natural gas from Caroline, Alberta, southeast across Alberta and Saskatchewan to the Canada/U.S. border near Monchy, Saskatchewan where it interconnects with Northern Border Pipeline Company. Natural gas transported through the Eastern Leg is primarily delivered to the U.S. Midwest market.	750 km (466 miles) of 1067-mm (42-inch) pipeline.
Kinder Morgan (Canada Inc.)	Kinder Morgan has two main pipeline systems – Trans Mountain and Express which carry crude oil, and refined petroleum products, such as aviation turbine fuel.	3,850 km (2,215-miles) of pipe.
	Kinder Morgan's Cochin Pipeline carries NGLs from Fort Saskatchewan, Alberta through North Dakota, Minnesota, Iowa, Illinois, Indiana, Ohio and Michigan before crossing into Sarnia, Ontario.	2,900 km (1,800 miles) of pipe.
Spectra Energy Corp.	The Spectra System transports natural gas from Fort Nelson, in Northeast British Columbia, to the British Columbia/U.S. border at Huntington/Sumas.	3,000 km (1,850 miles) of gathering system pipelines. 2,600 km (1,616 miles) of natural gas transmission pipeline.
TransCanada PipeLines Ltd.	Alberta: gathers natural gas in Alberta for use within the province and delivers it to provincial boundary points for connection with the Canadian Mainline, British Columbia System, the Foothills System and other pipelines.	23,186 km (14,407 miles) of pipe.
	British Columbia: extends from Alberta's western border through British Columbia to connect with the Gas Transmission Northwest System at the U.S. border, serving markets in British Columbia as well as the Pacific Northwest, California and Nevada.	201 km (125 miles) of pipe.
	Canadian Mainline: transports natural gas from the Alberta/Saskatchewan border east to the Québec/Vermont border and connects with other natural gas pipelines in Canada and the U.S.	14,898 km (9,257 miles) of pipe.

Source: CEPA

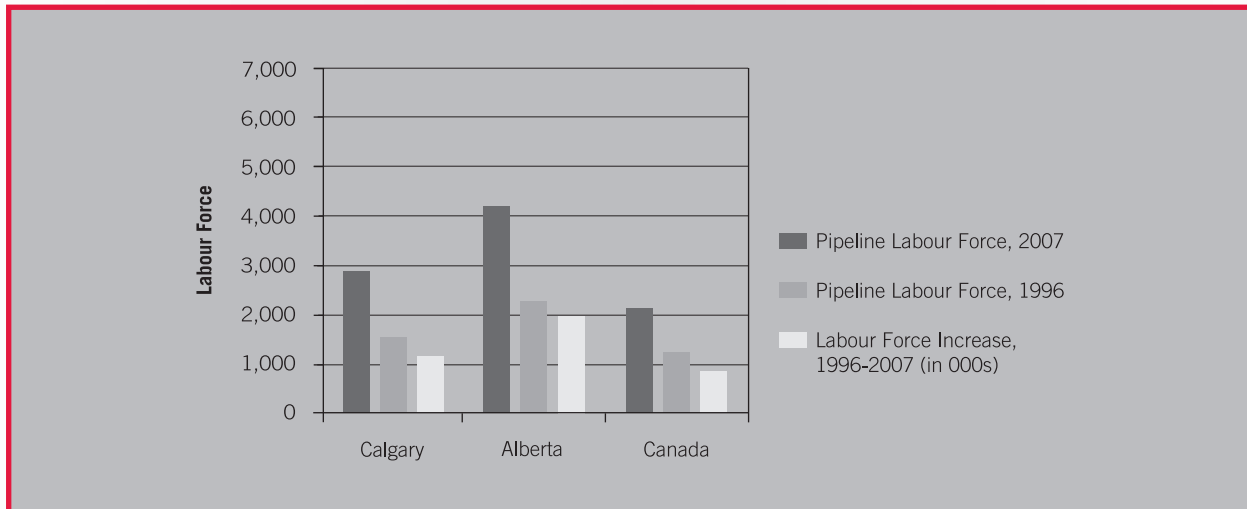
TABLE 19 – PROPOSED EXPORT PIPELINE PROJECTS

Name	Destination	Capacity (mil. cubic metres/day)	Start-up
Enbridge Gateway	U.S. West Coast, Offshore	63.6	2012-14
Southern Access	U.S. Midwest	50.1	2008-09
Alberta Clipper Pipeline	U.S. Midwest	71.5	2010
Kinder Morgan:	B.C., US West Coast, Offshore	–	–
Trans Mountain 1 Pump Stn. Exp.	–	5.6	2007
Trans Mountain 1 Anchor Loop Exp.	–	6.3	2008
Trans Mountain 2	–	15.9	2010
Trans Mountain 3	–	47.7	2012
TransCanada Keystone Pipeline	U.S. Midwest	93.8	2010
Altex Pipeline	U.S. Gulf Coast	39.7	2012

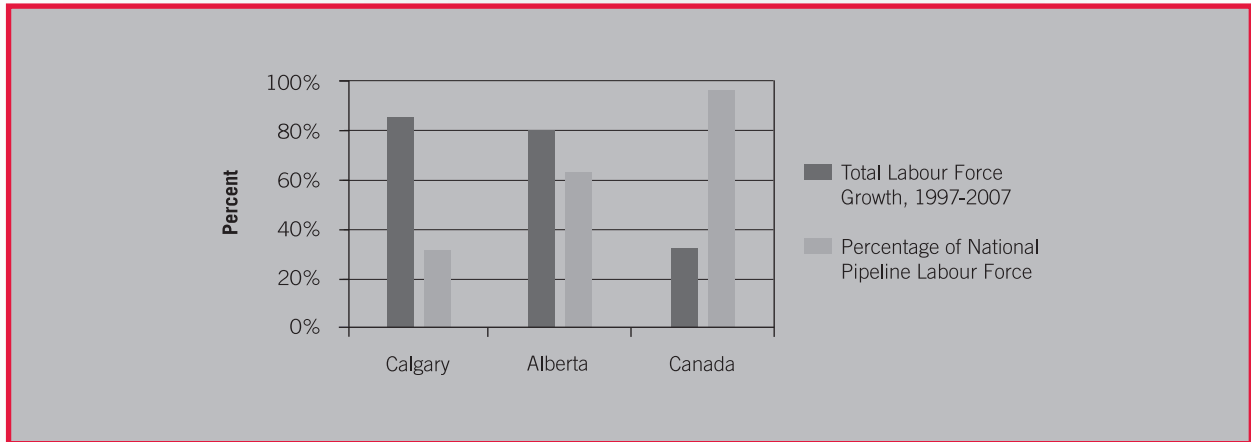
Source: CEPA

Future opportunities for pipeline growth include the development of new export routes for Alberta’s growing oil sands production. Additional pipeline infrastructure will provide an avenue for Alberta heavy crude to extend to larger markets in the U.S. and East Asia. With expected increases in both non-upgraded and upgraded bitumen over the forecast period, adequate incremental pipeline capacity is essential to market greater volumes of Alberta production.

TABLE 20 – KEY LABOUR FORCE STATISTICS FOR PIPELINE



Source: Statistics Canada, 1997 & 1998 pipeline data unavailable

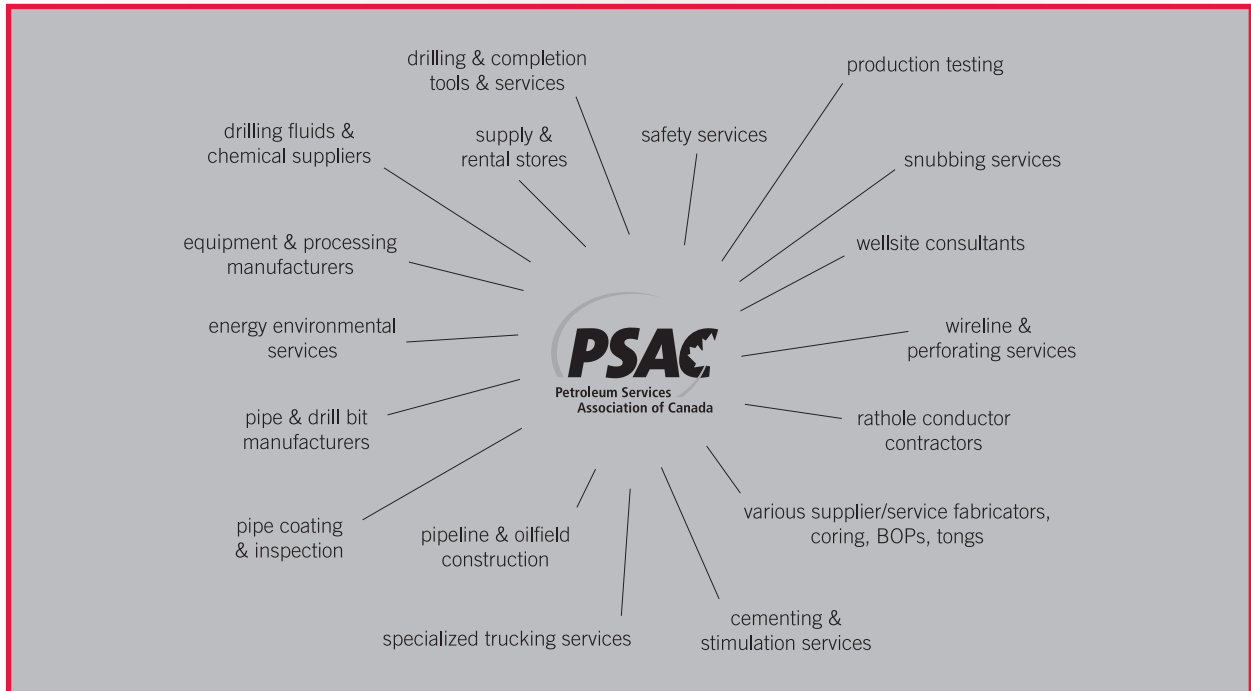


Source: Statistics Canada

Oil Field Services Overview

The petroleum-related service, supply and manufacturing sector consists of businesses that provide the specialized equipment and skills needed for: drilling, testing, producing, maintaining and reclaiming crude oil and natural gas wells. Many of these businesses involve the development and use of highly advanced technology. Calgary is home to a large labour pool of engineers, geologists, and other specialists serving the oil and gas extraction sector.

FIGURE 10 – PSAC SUB-SECTORS



Calgary is home to the Petroleum Services Association of Canada (PSAC), which represents service, supply and manufacturing sectors within the upstream petroleum industry. PSAC represents a diverse range of over 270 member companies, and contracts almost exclusively to oil and gas exploration and production companies.

Expertise in the following specialized procedures, among others, can be found in Calgary:

(1) **Well completion** is the procedure by which a successful well is readied for production. The process includes the installation of production casing, installation of the production tubing, perforation of the well, pump installation and stimulating the formation by physical or chemical means so that hydrocarbons can move more easily to the well. Well completion is another way to measure the economic output of the oil and gas sector. Once the well is drilled, and there are commercially viable quantities of oil or gas to extract, the well is then completed to allow for the flow of petroleum or natural gas out of the formation and up to the surface. In 2008, there were nearly 10,300 gas well completions and nearly 3,300 oil well completions in Alberta.

TABLE 21 – ALBERTA WELL COMPLETIONS, 2001-2008

	2001	2002	2003	2004	2005	2006	2007	2008
Oil	2,806	2,358	2,751	2,613	2,771	3,034	2,900	3,287
Gas	9,165	6,924	11,067	12,754	12,711	12,670	10,679	10,268
Dry	1,452	1,102	1,031	1,081	1,180	884	792	1,492
Servicing	134	161	119	200	249	99	82	319

Source: Nickle's Daily Oil Bulletin

(2) **Sulphur recovery** is an important oil field service in Alberta. About one third of Western Canada's natural gas production is "sour gas", meaning it contains significant amounts of hydrogen sulphide. Most of this sour gas is processed at special sulphur recovery plants using catalysts to extract elemental sulphur, which is then sold to fertilizer manufacturers and other industries. Sulphur recovery at sour gas plants increased from 95 per cent to 98.9 per cent in the 1970s. While the value of sulphur extraction continues to be realized, emissions from larger sour gas plants have decreased; from 273,000 tonnes in 1972, to just 64,000 tonnes 30 years later in 2002. This improvement in ecological footprint has occurred despite increasing growth in sour gas production in Western Canada. Oil sands mining projects near Fort McMurray, Alberta also include sulphur recovery as part of their facilities. Upgraders remove most of the sulphur from bitumen by converting it into elemental sulphur, or retaining it in a coke by-product. The remaining sulphur is released into the atmosphere as sulphur dioxide.

Sulphur recovery services available in Alberta include:

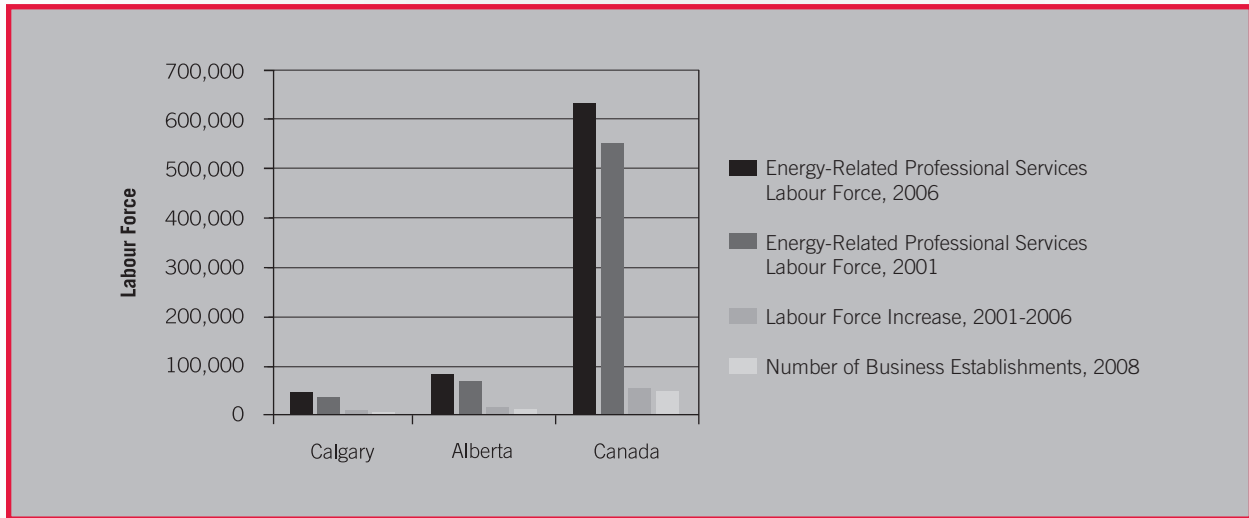
- Sulphur Recycling
- Sulphur Filtering
- Sulphur Melting
- Pouring to Block
- Base Pad Remediation
- Emergency Pad Remediation
- Emergency Response

Alberta Sulphur Research Ltd. was incorporated as a non-profit sulphur research organization in 1964. More than 90 per cent of Alberta's sulphur producing industry is active in ASRL, along with other organizations with sulphur related interests in Canada, the United States, the United Kingdom, France, Germany, Italy, Holland, Norway and Saudi Arabia.

(3) A variety of **environmental remediation services** are also offered in Alberta's oil field. These include site assessments (Phases I, II, and III), conservation and reclamation reports, environmental protection plans, environmental field reports, and other technical assessment services. In addition, environmental firms offer drilling waste management, ground and surface water testing and recovery, construction & drilling operation environmental monitoring, and site clean-up and reclamation.

Alberta's energy sector is also supported by an infrastructure of professional services which are concentrated in Calgary. Professional services provide the research, development, engineering, technical consulting and

technology to support the growth of Alberta's energy industry.



Source: Statistics Canada

Energy-related professional services represent the bulk of the professional, scientific and technical services industry in Calgary. Over the past decade, Calgary's professional, scientific and technical services industry has grown by nearly 37,000 employees. Over 28,000 workers are employed in Calgary's engineering and architecture sub-sector; over 13,000 are employed in computer systems design; and over 9,000 Calgarians are employed in management and scientific consulting services. There are over 1,875 workers directly employed in scientific research and development.

Coal Overview

Coal is the world's most abundant fossil fuel. Technologies, such as coal gasification, coal liquefaction, and carbon sequestration and storage, provide Alberta the potential to utilize its coal with near-zero, possibly even zero, emissions into the atmosphere. Alberta coal is low in sulphur and burns cleaner than most coal found in other countries.

	Alberta	Canada	World
Production (in million tonnes)	36.7	72.75	6,807
Reserves (in billion tonnes)	33.5	202	1,000,912
Consumption (in million tonnes)	N/A	65.4	6,743.8
Exports (trillion btu)	N/A	687	22,476

Source: EIA, Alberta Energy

One of Alberta's goals is to provide research that will lead to even cleaner, more efficient coal-burning technologies. The effort in adapting Clean Coal Technologies (CCTs) to Western Canada's coal is being led, in part, by the Alberta Energy Research Institute (AERI). For the past several years, AERI has been working with industry, universities, federal and provincial research agencies on projects to test and evaluate the gaps

Eleven major coal mines operate in Alberta, typically producing between 30 and 35 million tonnes of marketable coal every year. The Coal Association of Canada is also based in Calgary.

Canada is ranked 10th in the world in total proven coal reserves. Alberta represents 70 per cent of Canada's total reserves; there are 33.6 gigatonnes (Gt) of coal reserves in Alberta, with indications there are more than 2,000 Gt of coal in-place beneath the surface. At current rates of consumption, the province has enough coal for 600 to 800 years. In 2007, Alberta produced 32.5 megatonnes (Mt) of marketable coal. Sub-bituminous coal accounted for 80.1 per cent of the total, bituminous metallurgical 9.3 per cent and bituminous thermal coal the remaining 10.6 per cent.

Alberta's coal contains more than twice the energy of all the province's other non-renewable energy resources, including conventional oil and pentanes, natural gas, natural gas liquids, bitumen and synthetic crude. Currently, 49 per cent of the electrical power used in Alberta is generated by coal. Over 85 per cent of coal mined annually in Alberta is used in power plants.

SUB-BITUMINOUS COAL

Sub-bituminous coal is a type of coal whose properties range from those of lignite to those of bituminous coal and is used primarily as fuel for steam-electric power generation. Sub-bituminous coal may be dull, dark brown to black, soft and crumbly at the lower end of the range, to bright, jet-black, hard, and relatively strong at the upper end. It contains 20-30 per cent inherent moisture by weight. The heat content of sub-bituminous coal ranges from 17 to 24 million British thermal units (Btu) per short ton (20 to 28 megajoules per kilogram) on a moist, mineral-matter-free basis.

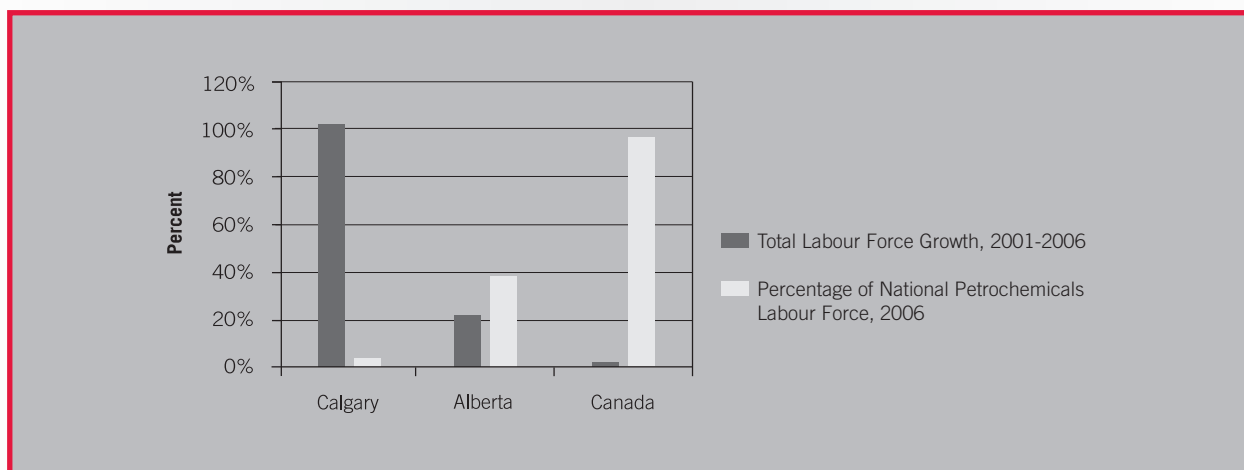
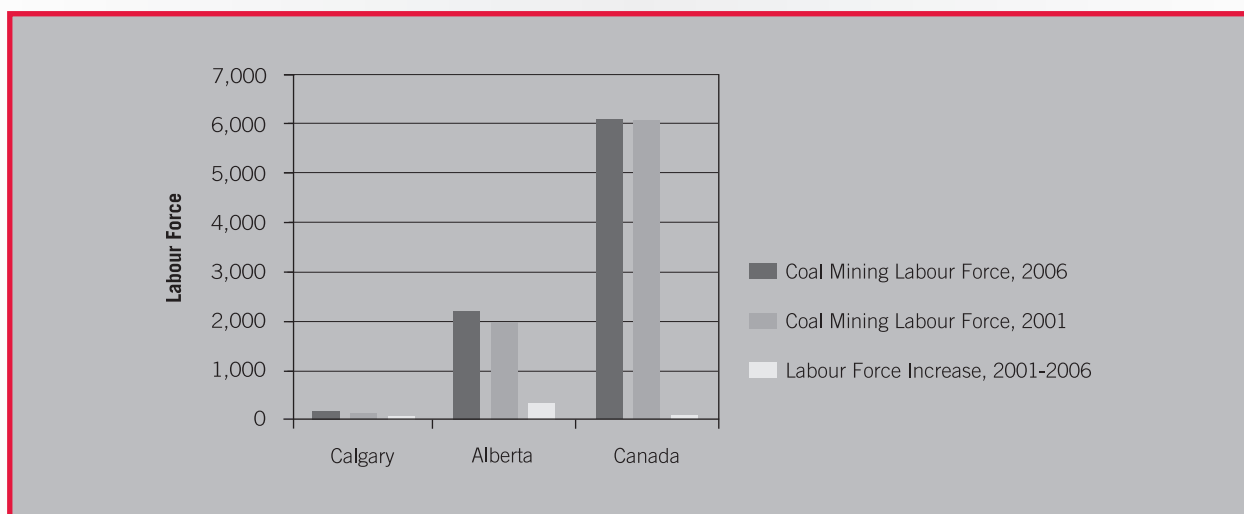
The heat content of sub-bituminous coal consumed in the United States averages 17 to 18 million Btu per short ton (20 to 21 MJ/kg), on the as-received basis (i.e., containing both inherent moisture and mineral matter). A major source of sub-bituminous coal in the United States is the Powder River Basin in Wyoming.

BITUMINOUS COAL

Bituminous coal is a relatively soft coal containing a tar-like substance called bitumen. It is of higher quality than lignite coal but poorer quality than anthracite coal. Bituminous coal is an organic sedimentary rock formed by diagenetic and sub metamorphic compression of peat bog material. Bituminous coal has been compressed and heated so that its primary constituents are the macerals vitrinite, exinite, etc. The carbon content of bituminous coal is around 60-80 per cent; the rest is composed of water, air, hydrogen, and sulphur, which have not been driven off from the macerals. The heat content of bituminous coal ranges from 21 million to 30 million Btu/ton (24 to 35 MJ/kg) on a moist, mineral-matter-free basis.

Coal mining operations are not heavily concentrated in Calgary, with only three per cent of Canada's coal mining labour force based in Calgary. But 41 per cent of Canada's coal mining labour force is based in Alberta, where the industry has seen 25 per cent labour force growth from 2001 to 2006.

TABLE 24 – KEY LABOUR FORCE STATISTICS ON COAL MINING



Source: Statistics Canada

ELECTRICITY OVERVIEW

Alberta's electricity system is owned and operated by a mix of investor-owned and municipally owned companies (most of them based in Calgary). The province's department of energy – Alberta Energy – develops supports and monitors the framework for bringing new generation on-line, competitive electricity markets and efficient delivery systems.

TABLE 25 – ALBERTA ELECTRICITY GENERATION CAPACITY

Electricity Generation Sources	Generating Capacity (MW)	
	1998	2007
Coal	5,636	5,918
Natural Gas (conventional)	1,200	1,141
Natural Gas (cogeneration)	802	3,463
Fuel Oil	6	16
Renewables (hydro, wind, biomass)	907	1,609
Total Installed Generating Capacity	8,552	12,142

Source: Alberta Energy

Alberta's competitive electricity market has resulted in over 3,590 megawatts (MW) of new electricity generating capacity since 1998. In addition, plans or proposals for new generation amounting to 5,330 MW of new generation have been announced. Planned investment in new generation and transmission is close to \$12.3 billion. To put this growth in perspective, one MW is equal to one thousand kilowatts, roughly equivalent to the power consumed by 1,000 typical Alberta households in an average year.

In 2007, peak demand increased by 40 MW, over the 2006 figure of 9,661 MW, to a new record high of 9,710 MW. Alberta's competitive energy market has encouraged development of new generation. The marketplace is now better able to respond to growing demand by allowing any participant the opportunity to build new generation capacity.

Alberta Energy names thermal sources as producing the majority of Alberta's installed generating capacity. Coal-fired plants make up almost 49 per cent of the province's total generating capacity and conventional natural gas accounts for over 9.3 per cent. Efficient natural gas cogeneration, which is produced by industrial operations that produce energy as a by-product of normal activities, accounts for 28.5 per cent.

Thirteen per cent of Alberta's electricity is generated through renewable resources including hydro, wind and biomass (energy produced from organic sources such as wood waste, garbage or animal matter). Proposals to add to the province's installed generating capacity also include a number of green power projects, such as the addition of up to 1,603 MW from wind generation and an additional 100 MW from hydro generation.

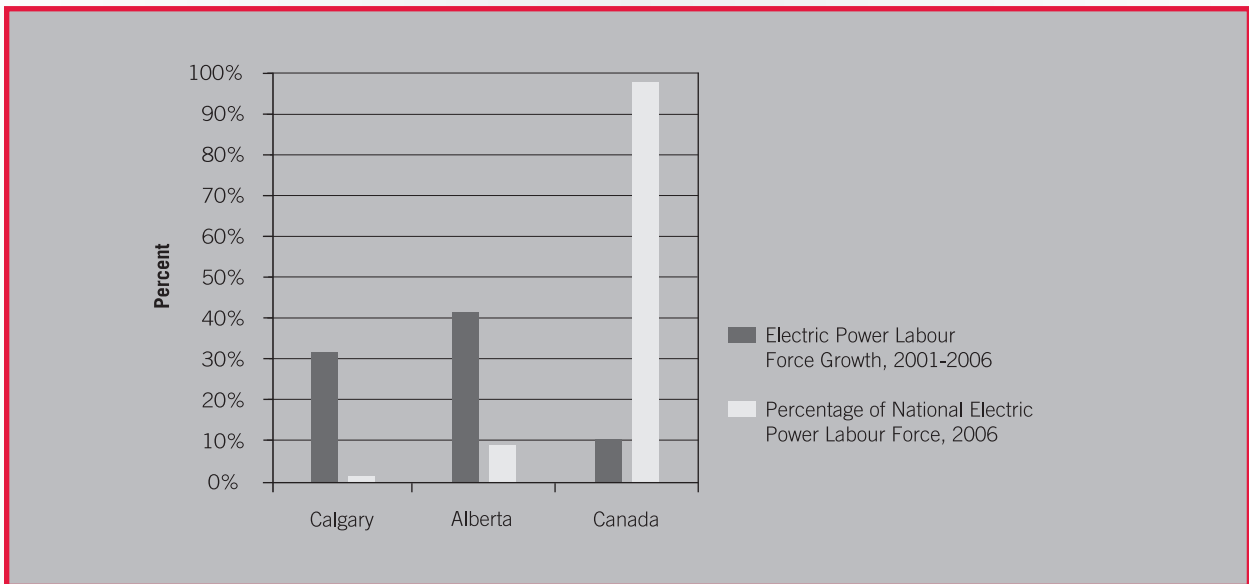
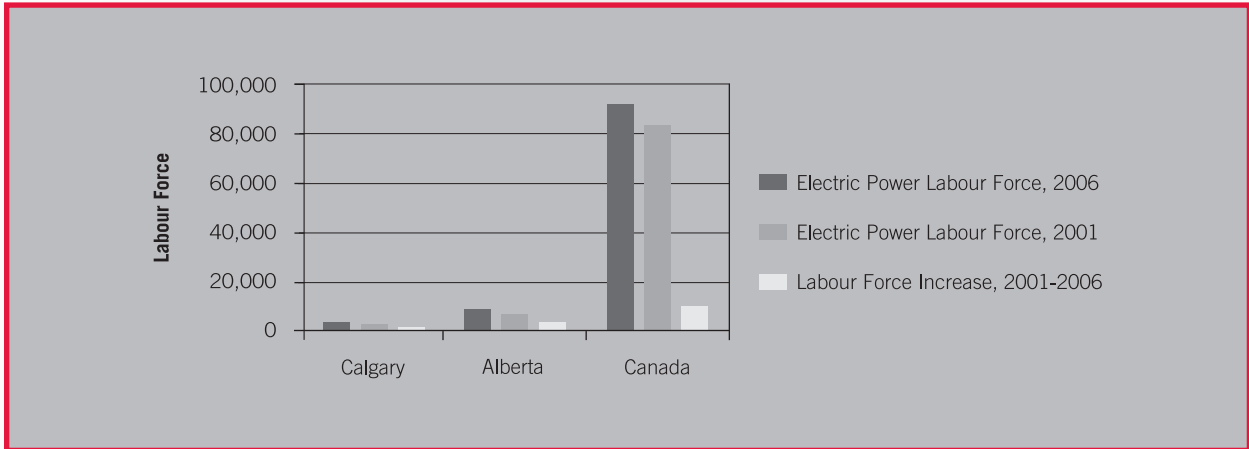
The ability to deliver electricity throughout Alberta must also be increased in order to keep pace with the province's continued strong economic growth. In late 2003, the Alberta government approved a new transmission development policy to encourage timely, cost-efficient investment in transmission infrastructure, the backbone of the electricity system. To ensure all transmission charges to generators and to industrial, commercial or residential customers are fair, the Alberta Utilities Commission (AUC) regulates the province's transmission system.

For nearly 100 years, ENMAX Corporation and its predecessor, The Calgary Electric System, has provided electricity to Calgary and the surrounding areas. Today, ENMAX Corporation is a billion dollar company serving the energy needs of customers across the province. A wholly owned subsidiary of The City of Calgary, ENMAX provides electricity, natural gas, renewable energy and other value-added services to residential and commercial customers.

Alberta's retail electricity market gives larger industrial and commercial consumers a choice of service providers. More than 20 companies are currently competing to sell power to the province's larger commercial and industrial users, which account for two thirds of all electricity use in Alberta. With the continued development of the retail market, more retail options will be available to smaller consumers such as residential, farm and small commercial customers.

Over the 2001-2006 period, Calgary's electric power labour force increased by 37 per cent, a compound annual growth of 3.2 per cent. Alberta's electric power labour force grew by 46 per cent over the same period and represents about 10 per cent of the Canadian labour force for electric utilities.

TABLE 26 – KEY LABOUR FORCE STATISTICS FOR ELECTRIC POWER



Source: Statistics Canada

SUSTAINABLE AND RENEWABLE ENERGY (SURE)

Alberta is responding to the world's growing demand for affordable, renewable and environmentally friendly energy. Companies across the province are finding innovative ways to use abundant and renewable resources – or biomass – such as cereal crops and animal waste.

Wind Energy

In 2007, Canada had 1,876 MW of wind generation installed, of which 550 MW is in Alberta, generating more wind energy than any other province. Alberta has eliminated the initial 900 MW cap on wind energy production and is designing transmission upgrades to connect 3,000 MW of wind in Southern Alberta. There are currently 13 major new wind generation projects proposed in Alberta, representing 1,603 additional MW of capacity and \$2.67 billion in investment in Alberta wind power generation.

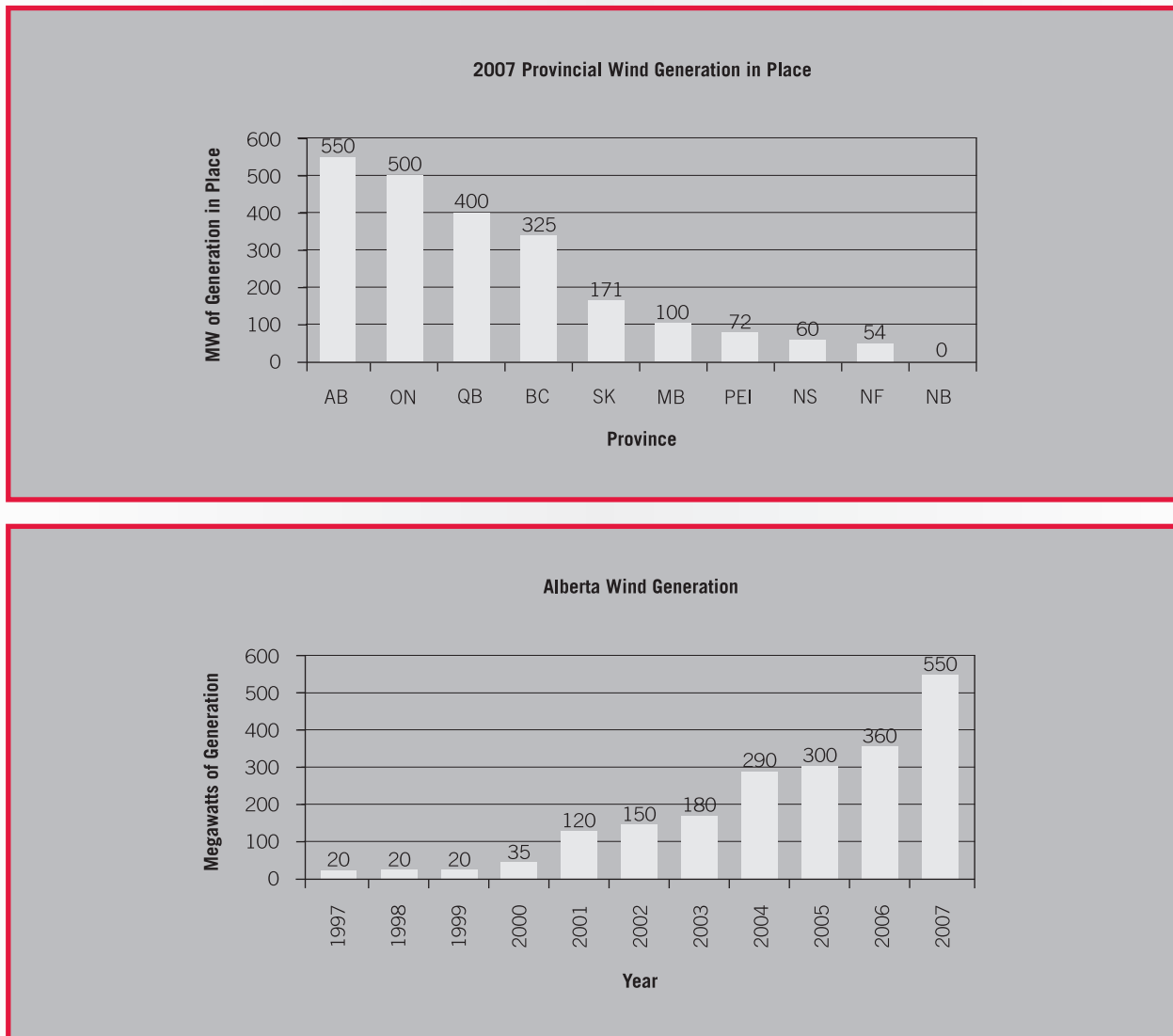
Calgary-based Suncor has four wind power projects in operation – SunBridge in Southwestern Saskatchewan, Magrath and Chin Chute in Southern Alberta and Ripley in Ontario. Together, these wind power projects have a generating capacity of 147 MW and reduce carbon dioxide emissions by approximately 284,000 tonnes each year.

Enbridge is currently involved in three wind power projects in Canada with an additional project being built in Ontario. Together these projects will have a combined capacity of more than 270 MW, enough electricity to meet the power requirements for about 100,000 homes.

In partnership with Canadian Hydro Developers, Nexen operates a wind farm at Soderglen – a \$113 million project to produce 70.5 MW per hour of clean electricity. It produces enough power to provide electricity to 25,000 homes and will offset 95,000 tonnes of CO₂ emissions per year.

In March 2009, Alberta Wind Energy Corp., in partnership with Mainstream Renewable Power, a leading European clean tech firm, unveiled plans to produce an additional 400 MW of wind-generated electricity in Alberta by 2013.

Wind energy currently represents only 0.8 per cent of total Canadian electric generation. Compared to countries like Denmark, where 20 per cent of generation is from wind, there is tremendous opportunity for growth.

FIGURE 11 – WIND GENERATION STATISTICS

Source: Compiled by RDA Global

Hydro

Hydro-electric generation produces 7.4 per cent of Alberta's electric generation capacity. Thirteen hydro-generation plants are in operation in Alberta, generating 800 MW of capacity in the foothills of Southern Alberta.

In Peace River Country, Glacier Power, a wholly owned subsidiary of Canadian Hydro Developers Inc. of Calgary, wants to use a time-tested source of energy – flowing water – to produce “low-impact renewable green energy” from a six-metre deep weir (a low-head, run-of-the-river generating facility) on the Peace River. The proposed facility has a generation capacity of 100 MW. The project is estimated at \$340 million.

Carbon Capture & Storage (CCS)

Carbon Capture and Storage (CCS) is the placement of CO₂ into a repository in such a way that it will remain stored and not release into the atmosphere. The Government of Alberta has recently allocated \$2 Billion to the first set of three CCS projects. This investment will result in five metric tons of annual CO₂ reductions from CCS, and will direct the country toward series of a made-in-Canada solutions for reducing emissions, and towards global leadership in CCS.

In March 2009, the Canadian government selected eight carbon capture and storage projects to receive a total of \$140 million in funding. Of these projects, four will be located in Alberta, and all eight of them will keep head offices in Calgary.

Geologic formations considered for CO₂ storage are layers of porous rock deep underground that are “capped” by a layer or multiple layers of non-porous rock above them. Sequestration practitioners drill a well down into the porous rock and inject pressurized CO₂ into it. Under high pressure, CO₂ turns to liquid and can move through a formation as a fluid. Once injected, the liquid CO₂ tends to be buoyant and will flow upward until it encounters a barrier of non-porous rock, which can trap the CO₂ and prevent further upward migration.

Alberta’s oil and gas reservoir formations have held crude oil and natural gas over numerous geologic eras. In general, they are a layer of porous rock with a layer of non-porous rock above such that the non-porous layer forms a dome. It is the dome shape that trapped the hydrocarbons. This same dome offers great potential to trap CO₂ and makes these formations excellent sequestration opportunities.

Calgary’s Enbridge Corporation is leading a group of 19 energy industry participants in the Alberta Saline Aquifer Project (ASAP). ASAP is a broad-based, industry-supported initiative that participants will roll out in three phases. This would include identification of suitable locations for the long term sequestration of CO₂, a pilot project during which sequestration sites will be designed to receive injected carbon dioxide, and expanding the project to a large-scale, long-term commercial sequestration operation.

EnCana’s CO₂ storage project in Weyburn is the world’s largest, full-scale scientific field study of its kind. It has become a global collaborative research and development project, attracting 15 industry sponsors and 25 research organizations from around the world.

CCS research is aimed at developing the ability to characterize a formation before CO₂ injection to be able to predict its CO₂ storage resource. Another area of research is the development of CO₂ injection techniques that achieve broad dispersion of CO₂ throughout the formation, overcome low diffusion rates, and avoid fracturing the cap rock. These areas of site characterization and injection techniques are interrelated because improved formation characterization will help determine the best injection procedure.

Biofuel

There were six biofuel facilities in Alberta in 2006-07, five biogas and one ethanol, representing 25 million litres of ethanol production in 2006. Alberta's electricity system is currently supported by two biomass plants which generate 1.3 per cent of Alberta's electricity generation capacity. Planned investment in three new biofuel and waste-to-fuel power plants in Alberta exceeds \$185 million. There are 17 proposed investments in ethanol production plants in Alberta totalling over \$2 billion.

Alberta has a wide range of feedstock available for biofuel generation, from forestry residuals to agricultural products and by-products, to waste generated in our cities and towns. The potential annual feedstock amounts in Alberta translate to an annual energy potential of 457 PJ, approximately 22.6 per cent of the total energy consumed in Alberta each year.

Calgary-based Suncor operates the St. Clair Ethanol Plant in the Sarnia-Lambton region of Ontario. The ethanol produced at this world-class facility is blended into Sunoco gasoline. Suncor is investing \$120 million to expand the St. Clair Ethanol Plant and double the production output to 400 million litres per year.

Canadian Hydro Developers also opened its Grande Prairie EcoPower® Centre in September 2005. The centre will use wood waste to generate electricity and steam for use in two sawmills; the Government of Alberta will purchase 60 per cent, or 110,000 megawatts per year, of the green power generated from this facility for 20 years. The EcoPower® Centre will generate enough electricity for about 21,000 households.

Fuel Cells

The Calgary region also includes a number of leaders in fuel cell technology. Versa Power Systems is a leading developer of solid oxide fuel cell technology.

Enbridge is leading an effort to transform its natural gas pipeline operations by integrating fuel cells within the pipeline infrastructure. They are developing a new hybrid fuel cell plant that will recover waste energy in the form of high pressure from gas distribution pipelines and convert this waste energy into electricity with zero emissions.

It was recently announced that Alberta Energy Research Institute (AERI), on behalf of Alberta Innovation and Science, will establish and operate the Energy INet Alternative and Renewable Energy (Energy INet-ARE) Fuel Cell Program. This initiative will support the systemic investigation, evaluation, development and deployment of commercial “impure” hydrogen fuel cell technology. It will operate under the Western Canada Fuel Cell Initiative, a network of Western Canadian universities and the Alberta Research Council working on fuel cell and related technologies. Research will be carried out at the University of Alberta, University of Calgary and the Alberta Research Council.

Solar

With Alberta being one of the sunniest provinces in Canada, tremendous potential exists for the solar industry to become a key energy industry in Calgary. Solar power has a long history in Alberta’s oil and gas industry where it is used to power remote monitoring and control systems, but steady cost reductions have now made solar power a very attractive option for mainstream grid tied systems as well. Both the Province of Alberta and the City of Calgary acknowledge this huge opportunity and are expected to encourage the growth of the local solar industry.

The solar industry will also feel right at home in Calgary drawing on talent from two of the city’s key industries: manufacturing and energy. The idea of generating energy on-site to meet your own needs also appeals to a deep-seated Albertan regard for self-sufficiency.

One local firm providing leadership in the global solar market is Sustainable Energy Technologies – a manufacturer of solar inverters. Many companies offering solar design, installation and support services are also based in the city.

The University of Calgary is also a leading centre for solar R&D. The building integrated solar power system at its new Child Development Centre was awarded The Canadian Solar Industries Association’s project of the year in 2007, and the new Canada Research Chair for Energy Conversion is Dr. Curtis Berlinguette whose research is focused on low-cost dye-sensitized solar cells.

With solar energy prices dropping steadily, photovoltaic is now becoming an affordable option for urban homes and businesses. Solar-powered hot water, viable throughout Alberta, is economically sound and an installation can pay for itself in three years or less.

In 2007, a second solar-electric (PhotoVoltaic) system was installed at the Biosphere Institute of Bow Valley. This small one-kilowatt installation was designed to educate the public and increase governmental support for solar energy.

Nuclear

Atomic Energy of Canada Ltd (AECL) has undertaken research – with oil sands producers – on the potential for using nuclear power to supply the large amounts of energy required to recover the resource.

Among the ideas studied in oil sands development is pumping steam by-products from a nuclear plant to liquefy underground deposits or using electricity to heat rock to release the oil. Nuclear power could also replace natural gas-fired plants to make hydrogen for oil upgrader plants.

In May 2008, the Alberta government engaged an expert panel on nuclear power to prepare a balanced and objective report for the province, outlining the facts and issues pertinent to the use of nuclear-powered electricity in Alberta. The panel submitted its detailed report in the first quarter of 2009.

Given the level of discussion and debate provoked by nuclear power around the world, and the ongoing adoption of unconventional sources of energy (such as wind and solar) throughout the province, the potential of nuclear power continues to be of interest in Alberta.

CALGARY'S ENGINEERING SERVICES

Calgary boasts the highest concentration of engineering workers in Canada. Engineering, Procurement and Construction (EPC) firms handle mega-projects. Typically, EPC firms oversee contracting through nationally-based subsidiaries that handle portions of the design and building of such projects as oil sands operations and refineries.

Over the previous decade, Calgary's engineering labour force has grown by 17,000 engineers, resulting in over 100 per cent growth, and growth in engineers and engineering technicians is expected to remain strong as the industry serves large investments in Alberta's energy sector.

A review of occupational statistics compiled by Statistics Canada shows that during the period 1997 to 2007, employment in Calgary engineering occupations consistently outperformed the provincial and national industry norms. During this time period, Calgary's engineering labour force and total employment grew by more than 101 per cent. Calgary has the highest concentration of engineers and technologists among all major Canadian centres.

Calgary's engineering labour force has grown an average of 7.2 per cent each year for the past decade, representing a 41 per cent faster growth rate per year than the province, and over 150 per cent per year faster than Canada's growth rate for this occupation.

Engineering jobs represent 4.6 per cent of Calgary's total employment, up 39 per cent from 10 years earlier when engineering occupations represented 3.3 per cent of Calgary's total employment. Calgary's share of engineering employment is higher than that of Alberta (3.1 per cent) or Canada (2.3 per cent).

TABLE 27 – ENGINEERING JOBS AS A PER CENT OF ALL JOBS

	1997	2007	Change
Calgary	3.3%	4.6%	39.4%
Alberta	2.5%	3.1%	24.0%
Canada	2.1%	2.3%	9.5%

Source: Statistics Canada

Calgary has one of the highest concentrations of engineers in the world. There are 33.5 engineers per 1,000 workers in Calgary. Ottawa has the next highest concentration among Canadian cities, with 18.8 engineers per 1,000 workers. Calgary also has the highest concentration of engineering technologists among Canadian cities with 46.4 engineering technologists per 1,000 workers. Edmonton has the second-highest concentration with 28.4 technologists per 1,000 workers.

TABLE 28 – CMA COMPARISON OF CONCENTRATION OF ENGINEERING & TECH JOBS, 2007

City	Engineering Occupations	Engineers Per 1000	Engineering Technologists Occupations	Engineering Technologists Per 1,000	Total Workers
Calgary	22,800	33.5	31,600	46.4	680,600
Edmonton	8,400	14	17,000	28.4	599,100
Vancouver	14,900	12.2	26,700	21.8	1,222,700
Toronto	42,700	14.9	65,000	22.6	2,865,500
Ottawa	11,600	17.8	17,300	26.6	651,500
Montreal	31,100	16.3	53,700	28.2	1,902,600

Source: Statistics Canada

About 34 per cent of Calgary's engineers and technologists are civil, mechanical, electrical, and chemical engineers. About 39 per cent are industrial, manufacturing, mining, geological, petroleum, aerospace and computer engineers. Civil, mechanical and industrial technologists make up about 10 per cent of workers and about 18 per cent are electronic and electrical engineering technologists, electronic service technicians, industrial instrument technologists or other technicians.

HUMAN CAPITAL

The University of Calgary

Ranked one of Canada's top seven research universities, the University of Calgary is home to scholars in 18 faculties, over 100 academic programs and more than 30 research institutes and centres. In 2007-2008, the university enrolled more than 27,000 full and part-time students and employed 1,731 academic staff, 976 academic sessionals and 54 senior administrators. The university produces an estimated economic impact of \$1 billion to the Calgary area.

There are nine academic programs offered by the Schulich School of Engineering that lead to the University of Calgary's Bachelor of Science Degree in engineering and all are fully accredited by the Canadian Council of Professional Engineers. Specializations are available in chemical, civil, computer, electrical, geomatics, manufacturing, mechanical, and oil and gas software engineering. The school has also recently added an Engineering and the Environment Specialization, in addition to the Biomedical Engineering Specialization. There are currently 2,800 full-time undergraduates, 1,000 graduate students, 200 faculty members and 35 international recognized research chairs at the Schulich School of Engineering.

One of the more than 50 institutes, centres and centres of excellence at the University of Calgary is the Institute for Sustainable Energy, Environment and Economy (ISEEE), which undertakes world-class interdisciplinary research, innovation and education. ISEEE is focused on creating secure, competitive energy supplies for a clean environment and a strong economy. ISEEE builds on considerable strengths in research and academic programs in energy and the environment at the University of Calgary. With support from its partners, ISEEE has also launched a new research network – Carbon Management Canada (CMC) – focused on carbon management in Canada's fossil energy sector.

For further information please contact:

University of Calgary

2500 University Drive NW
Calgary, Alberta, T2N 1N4
Phone: 403-220-5110
<http://www.ucalgary.ca>



SAIT Polytechnic

SAIT Polytechnic is known worldwide for its quality technical education and hands-on training. SAIT Polytechnic has over 2,300 continuing education courses and more than 70 applied degree, diploma and certificate programs. SAIT Polytechnic provides education and first class training for more than 65,000 learners beginning and enhancing their careers each year.

The MacPhail School of Energy at SAIT Polytechnic is one of only a handful of energy schools in North America. The school provides training to 1,200 full-time and 8,000 continuing education students each year and employs 150 managers, faculty and support staff. Training is available in all major areas of the energy industry, including petroleum, electrical, chemical, process, power, instrumentation and environmental training. The MacPhail School of Energy is also home to five Centres of Technology which offer advanced research and training opportunities across all aspects of the energy sector, from wellsite production to alternate sources of power.

For further information please contact:

SAIT Polytechnic

1301 16th Ave NW

Calgary, Alberta, T2M 0L4

Phone: 403-284-SAIT (7248)

Toll free: 1-877-284-SAIT (7248)

<http://www.sait.ab.ca>



Mount Royal College

Mount Royal College was founded in 1910 to help students achieve their full potential. Today, over 12,000 students from Canada and around the globe work toward this goal every year. Mount Royal College offers more than 60 degree, diploma, university transfer and certificate programs in areas such as arts, business, communications, health and community studies and science and technology. International exchange agreements with leading educational institutions in the United States, Mexico and Asia provide global learning opportunities.

Mount Royal College's Faculty of Science and Technology prepares students to work in Calgary's energy sector through programs in earth sciences, and university transfer programs in oil and gas, chemical, computer, mechanical, civic, geomatics and electrical engineering.

For further information please contact:

Mount Royal College

4825 Richard Road SW
Calgary, Alberta, T3E 6K6
Phone: 403-444-6611
<http://www.mtroyal.ca>

DeVry Institute of Technology

DeVry Institute of Technology (DeVry) offers bachelor's degree and diploma programs that combine today's business skills with current technical applications. DeVry is part of the DeVry University system, which also offers undergraduate and graduate programs online.

For further information please contact:

DeVry Calgary

2700 3rd Avenue SE

Calgary, Alberta, T2A 7W4

Phone: 403-235-3450

Toll free: 1-800-363-5558

<http://www.devry.ca>

Bow Valley College

Bow Valley College serves more than 11,000 learners (about 4,100 full-load equivalents) each year in Calgary, at campuses throughout Southern Alberta and, through contract arrangements, across Canada and in a number of other countries.

The college offers year-round programs leading to career certificates and diplomas, and adult upgrading and English as a Second Language (ESL) courses. In addition, career planning and assessment services are provided to 20,000 Albertans per year, along with other specialized services for businesses and organizations.

For further information please contact:

Bow Valley College

332 – 6 Avenue SE

Calgary, Alberta T2G 4S6

Phone: 403-410-1400

<http://www.bowvalleycollege.ca>

FINANCIAL ASSISTANCE AND RESEARCH FUNDING

Federal Funding

SCIENTIFIC RESEARCH AND EXPERIMENTAL DEVELOPMENT (SR&ED) PROGRAM

The Scientific Research and Experimental Development (SR&ED) program is a federal tax incentive program to encourage Canadian businesses of all sizes and in all sectors to conduct research and development (R&D) in Canada that will lead to new, improved, or technologically advanced products or processes.

The SR&ED tax incentive program is one of the most advantageous systems in the industrialized world for supporting business investment in research and development (R&D), providing over \$4 billion in tax assistance in 2007.

In its 2007 budget and strategy report on science and technology, Mobilizing Science and Technology to Canada's Advantage, the Government committed to improve the SR&ED tax incentive program, including its administration, in a cost-effective manner. To that end, consultations were undertaken on how to make the SR&ED tax incentives more effective for Canadian businesses.

<http://www.cra-arc.gc.ca/txcrdt/sred-rsde/menu-eng.html>

CONRAD: CANADIAN OIL SANDS NETWORK FOR RESEARCH AND DEVELOPMENT

CONRAD is a network of companies, universities and government agencies organized to facilitate collaborative research in science and technology for Alberta Oil Sands.

<http://www.conrad.ab.ca>

NATURAL RESOURCES CANADA - CANMET ENERGY TECHNOLOGY CENTRE

The CANMET Energy Technology Centre (CETC) – Devon is the federal government's primary research group for the development of hydrocarbon supply technologies and related environmental technologies, with an emphasis on oil sands and heavy oil upgrading and refining and separation technologies for oil sands surface mining applications.

http://www.nrcan.gc.ca/es/etb/cwrc/English/home_e.html

NATIONAL RESEARCH COUNCIL, OFFICE OF ENERGY RESEARCH AND DEVELOPMENT

The Office of Energy Research and Development (OERD) is the Government of Canada's coordinator of energy research and development activities. The organization manages and funds three energy R&D programs:

- the Program of Energy Research and Development (PERD);
- the Technology and Innovation Research and Development (T&I R&D) Initiative; and
- the ecoENERGY Technology Initiative

<http://www.nrcan-rncan.gc.ca>

NRC INDUSTRIAL RESEARCH ASSISTANCE PROGRAM (NRC-IRAP)

IRAP offers direct technical assistance, access to the latest technological advances, expertise, facilities, and resources, as well as cost-shared financing of innovative technical projects.

http://irap-pari.nrc-cnrc.gc.ca/main_e.html

NRC-IRAP WEST

<http://www.nrc-cnrc.gc.ca/eng/ibp/irap/about/alberta-nwt.html>

GOING GLOBAL SCIENCE AND TECHNOLOGY FUND

The Going Global Science and Technology (S&T) Fund is a program specifically designed to promote and enhance Canada's international science and technology efforts by supporting Canadian researchers in accessing international R&D collaborative opportunities through the development of partnerships with key players in other countries/economies.

<http://www.infoexport.gc.ca/science/gglobal-en.htm>

FUNDING TECHNOLOGIES FOR THE ENVIRONMENT

Funding Technologies for the Environment (FTE) is a new Environment Canada tool helping to broker the development, demonstration and deployment of innovative technology solutions that address Canada's environmental priorities. Towards achieving this goal, FTE provides technology stakeholders, including developers, with strategic information about funding programs and incentive sources.

<http://www.ic.gc.ca/eic/site/fte-fte.nsf/eng/home>



CANADIAN ENERGY RESEARCH INSTITUTE

The Canadian Energy Research Institute (CERI) is an independent, non-profit research institute providing analysis of energy economics and related environmental policy issues in the producing, transportation, and consuming sectors. A central goal of CERI is to build bridges between scholarship and policy; bringing the insights of scientific research, economic analysis, and practical experience to the attention of government policy-makers, business sector decision-makers, the media, and citizens in Canada and abroad.

<http://www.ceri.ca>

Alberta Programs

ALBERTA SCIENTIFIC RESEARCH AND EXPERIMENTAL DEVELOPMENT (SR&ED) TAX CREDIT PROGRAM

Alberta's SR&ED tax credit program provides a refundable tax credit to corporations for SR&ED expenditures incurred in Alberta by corporations. The program came into effect on January 1, 2009 for SR&ED expenditures incurred in Alberta after December 31, 2008. A corporation with a permanent establishment in Alberta at any time during the taxation year and that carries on eligible activities in the taxation year is eligible to make a claim. The tax credit offers a maximum of \$400,000 in tax credit in a taxation year. The credit is based on 10 per cent of the eligible Alberta SR&ED expenditures to a maximum expenditure limit of \$4 million.

http://www.finance.alberta.ca/publications/tax_rebates/faqs_corporate.html#definition

ALBERTA ENERGY – INNOVATIVE ENERGY TECHNOLOGIES PROGRAMS (IETP)

The Innovative Energy Technology Programs represents a \$200 million commitment over five years by Alberta Energy to provide royalty adjustments to a number of specific pilot and demonstration projects that use innovative technologies to increase recoveries from existing reserves and encourage responsible development of oil, natural gas and in situ oil sands reserves. The program is also designed to assist industry in finding commercial technical solutions to the gas over bitumen issue that will allow efficient and orderly production of both resources.

Successful applicants in the program will be provided royalty adjustments of 30 per cent of approved costs up to a maximum of \$10 million per approved project. Industry must provide the remaining 70 per cent or more of total project costs.

<http://www.energy.gov.ab.ca/Oil/768.asp>

ALBERTA ENERGY RESEARCH INSTITUTE (AERI)

AERI invests with industry and other organizations in research and technology development in six program areas: bitumen upgrading, clean carbon/coal, improved recovery, renewable and alternate energy, CO₂ management and water management. Organizations developing Alberta's resources are eligible to apply to AERI for funding for the development of novel research and technology solutions that will help sustain and grow Alberta's economy while improving environmental performance.

<http://www.aeri.ab.ca>

ENERGY ENVIRONMENTAL TECHNOLOGY FUND (EETF) PROJECTS

On September 20, 2006, the AERI Board approved \$300,000 for the Energy Environment Technology Fund. The fund was established between Alberta Environment and the Alberta Energy Research Institute (AERI) to fund projects that advance environmentally friendly and energy efficient technologies for Western Canada's energy industry.

<http://environment.alberta.ca/2264.html>

ALBERTA RESEARCH COUNCIL (ARC)

The Alberta Research Council delivers innovative science and technology solutions to meet the priorities of industry and government in Alberta and beyond. They support the growth of innovative companies by extending an organization's technical services, as well as research and development capabilities.

ARC undertakes experimental, theoretical and field investigations into all aspects of in situ heavy oil recovery, from fundamental properties to field pilots. They also work with industries involved in the extraction of bitumen from mine-able oil sands and oil shale. Much of this research is carried out under the AERI/ARC Core Industry (AACI) Research Program. This consortium program serves the longer term research needs of the upstream and downstream heavy oil and oil sand industries.

<http://www.arc.ab.ca>

Please note that the above list is not exhaustive, just a sampling of the financial assistance and research funding programs that are available to companies operating in the energy sector.

ASSOCIATIONS, RESEARCH ORGANIZATIONS & POLICY INSTITUTES

ALBERTA SULPHUR RESEARCH LTD (ASRL)

ASRL fosters research in the areas of the chemistry and technology of sulphur, and its compounds with particular emphasis on recovery of sour natural gas, Claus plant operations, handling and transportation of elemental sulphur, and environmental aspects of the gas and sulphur industries. ASRL serves as a contact point between industry and academia (at the University of Calgary) and strives to provide an expert level of technological support for both producers and users of this essential resource.

<http://www.chem.ucalgary.ca/asr>

THE CANADIAN CENTRE FOR ENERGY INFORMATION

The Canadian Centre for Energy Information was created to meet a growing demand for balanced, credible information about the Canadian energy system and energy-related issues. The Centre's web portal covers the Canadian energy system from the mainstays of oil, natural gas, coal, nuclear and hydropower through to solar, wind and other alternative sources of energy. The Centre's vision is to help North Americans make informed decisions regarding Canadian energy and energy-related issues.

<http://www.centreforenergy.com>

CLIMATE CHANGE CENTRAL

Late in 1999, the Alberta government brought private and public sector leaders together to find an effective way to manage climate change challenges in the province. The concept of Climate Change Central was formed, and in 2000, the public-private not-for-profit organization was officially launched. The organization's main focus is on reducing greenhouse gases – policy, energy efficiency, technology development, environmental communications, etc. The goal of Climate Change Central is to empower Albertans to take action on climate change.

<http://www.climatechangecentral.com>

CANADIAN HEAVY OIL ASSOCIATION (CHOA)

The Canadian Heavy Oil Association has as its mission to provide an appropriate technical, educational and social forum for those employed in, or associated with, the heavy oil and oil sands industries. The association publishes a guidebook and directory that provides a sense of the diversity, dynamics and growth of the industry and also addresses the challenge as the industry continues to grow. The CHOA provides a forum for its members to keep current on business issues that affect the heavy oil and oil sands industries.

<http://www.choa.ab.ca>

Other notable associations located in Calgary, some of which have already been mentioned, are:

Canadian Association of Petroleum Producers (CAPP)

<http://www.capp.ca>

Small Explorers and Producers Association of Canada (SEPAC)

<http://www.sepac.ca>

Petroleum Services Association of Canada (PSAC)

<http://www.psac.ca>

Canadian Energy Pipeline Association

<http://www.cepa.com>

Petroleum Technology Alliance Canada

<http://www.ptac.org>

Canadian Association of Geophysical Contractors

<http://www.cagc.ca>

Canadian Geothermal Energy Association

<http://www.cangea.ca>

Canadian Association of Oilwell Drilling Contractors

<http://www.caodc.ca>

Canadian Society of Unconventional Gas (CSUG)

<http://www.csug.ca>

Coal Association of Canada

<http://www.coal.ca>

Calgary is also home to three major energy regulators:

NATIONAL ENERGY BOARD (NEB)

Based in Calgary, the NEB is an independent federal agency that regulates several aspects of Canada's energy industry. It promotes safety, environmental protection and economic efficiency in the interest of all Canadians and within the federal regulation of pipelines, energy development and trade. The NEB provides Calgary energy companies ready access to federal government regulations and relevant officials, eliminating costly travel and reducing communication and administrative costs.

<http://www.neb.gc.ca>

ALBERTA ENERGY RESOURCES CONSERVATION BOARD (ERCB)

The ERCB is an independent, quasi-judicial agency of the Government of Alberta. The Board regulates the safe, responsible and efficient development of Alberta's energy resources: oil, natural gas, oil sands, coal and pipelines. Its mission is to ensure that the discovery, development and delivery of Alberta's energy resources take place in a manner that is fair, responsible and in the public interest.

<http://www.ercb.ca>

ALBERTA UTILITIES COMMISSION (AUC)

The AUC is a quasi-judicial independent agency established by the Government of Alberta, responsible to ensure that the delivery of Alberta's utility service takes place in a manner that is fair, responsible and in the public interest. The AUC regulates investor-owned natural gas, electric, water utilities and certain municipally owned electric utilities to ensure that customers receive safe and reliable services at just and reasonable rates. Staff also respond to customer inquiries and complaints respecting utility matters. In addition, AUC ensures that electric facilities are built, operated and decommissioned in an efficient and environmentally responsible way. The AUC also provides regulatory oversight of issues related to the development and operation of the wholesale electricity market in Alberta as well as the retail gas and electricity markets in the province.

<http://www.auc.ab.ca>

- ¹ Source: CAPP 2007 Statistics and IEA 2008 World Energy Report
- ² Source: CAPP 2007 Statistics and IEA 2008 World Energy Report
- ³ Source: Alberta Government, "Alberta's Oil Sands," September 2008
- ⁴ Direct and Indirect employment was measured in 2006 by CAPP. This includes employment directly related to oil and gas and employment in other industries that are related to oil and gas sector. CAPP's 2006 figure is derived from an input-output model that was estimated in 2006. Direct employment in Oil and Gas extraction and support activities was a 132,200 workers in 2006 and 141,600 in 2007 an increase of 7.1%
- ⁵ Cumulative Production represents all production that has occurred since the reserve size was established through 2007. Of the 178.7 BB initially established, 5.9 BB have been produced bringing the remaining established to 172.7 BB
- ⁶ Source: ERCB Alberta's Supply and demand Outlook 2008-2017. Cumulative Production represents all production that has occurred since the reserve size was established through 2007. Of the 321 TCF initially established, 141 TCF have been produced bringing the remaining established to 40.5 TCF

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