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# I N D U S T R Y P R O F I L E

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Regional Industrial  
Expansion

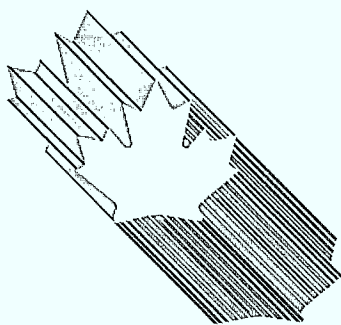
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Expansion industrielle  
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## Petrochemicals

Canada



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## 1. Structure and Performance

## FOREWORD

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In a rapidly changing global trade environment, the international competitiveness of Canadian industry is the key to survival and growth. This Industry Profile is one of a series of papers which assess, in a summary form, the current competitiveness of Canada's industrial sectors, taking into account technological and other key factors, and changes anticipated under the Canada-U.S. Free Trade Agreement. Industry participants were consulted in the preparation of the papers.

The series is being published as steps are being taken to create the new Department of Industry, Science and Technology from the consolidation of the Department of Regional Industrial Expansion and the Ministry of State for Science and Technology. It is my intention that the series will be updated on a regular basis and continue to be a product of the new department. I sincerely hope that these profiles will be informative to those interested in Canadian industrial development and serve as a basis for discussion of industrial trends, prospects and strategic directions.

Minister

Canada

## Structure

Petrochemicals are organic chemicals manufactured from raw materials, or "feedstocks", derived from crude oil and natural gas. The industry uses about four percent of the crude oil consumed in Canada (domestic and imported) and 25 percent of domestic natural gas sales. These feedstocks are converted into the first-stage, or primary, petrochemicals, the most important of which are:

- the olefins — ethylene, propylene, butadiene;
- the aromatics — benzene, toluene, xylenes; and
- methanol.

Although ammonia is produced from natural gas, it is not included in the statistics presented in this profile. Ammonia is not an organic chemical and is usually regarded as an agricultural chemical.

These first-stage chemical products are upgraded to intermediates (also petrochemicals) such as styrene, ethylene dichloride, and the large-volume plastic resins which include polyethylene and polyvinyl chloride. Intermediates are the raw materials for a wide range of downstream (customer) industries such as synthetic rubber, plastics processing, paints, inks, adhesives and synthetic textiles.

The primary and intermediate producers are interdependent and both require downstream customers. Downstream industries can obtain their raw materials from domestic or foreign sources.

The petrochemical industry makes up more than 60 percent of the chemical manufacturing industry in Canada and in 1986 had shipments of \$5.1 billion. Its production capacity is spread over 52 plant sites in four provinces, with Ontario accounting for approximately 59 percent, Alberta 24 percent, Quebec 15 percent and British Columbia two percent of shipments. The newer western sector is primarily gas-based, while the eastern sector mainly uses oil-based raw materials.

Direct employment in the industry is approximately 14 000. As more labour-intensive downstream industries tend to locate near markets, most of the downstream employment has been in Ontario and Quebec. The growth of the petrochemical industry in Alberta has not changed this.

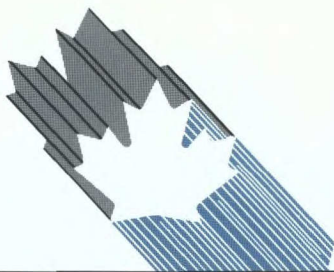
Companies involved in the sector are, for the most part, large multinationals, the majority being foreign controlled. Polysar and Novacor are large, Canadian-owned companies in the sector.

Integration with the foreign parent (mainly U.S.) is important for parts of the export-dependent, gas-based sector, with companies such as Dow, Union Carbide and Celanese marketing their products in export markets through their U.S. corporate operations.

Government ownership in the industry is limited to the Quebec government's 50 percent partnership, through Société générale de financement, in Pétromont, the Quebec ethylene producer.

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Imports, Exports and Domestic Shipments  
1986

The United States is by far Canada's most important petrochemical trading partner, taking 56 percent of Canadian exports and supplying more than 70 percent of Canadian imports. The European Community (E.C.) supplies 19 percent of Canadian imports and takes 12 percent of exports. The only other significant individual contributor to Canadian trade is Japan which is the destination for seven percent of Canadian exports.

#### Performance

Much of the new petrochemical capacity built in the world during the late 1970s and early 1980s was sited in energy-rich locations, including Alberta, since security of feedstock supply and feedstock costs were of prime concern. The Canadian industry developed in an atmosphere of:

- secure domestic supplies of crude oil and natural gas;
- Canadian energy prices regulated below world levels to give Canadian industry an advantage; and
- the expectation of ever-increasing world energy pricing that would give Alberta's land-locked ethylene derivative producers an increasing raw material advantage from their cost-of-service ethylene contracts under which the price of ethylene increases only if the cost of production increases.

From the mid-1970s, as a result of investment in world-scale facilities, the sector's historical deficit in external trade was rapidly reduced. A trade surplus was achieved for the first time in 1979.

The worldwide recession that started in 1982 and falling energy prices outside Canada resulted in an erosion of petrochemical prices worldwide, particularly for the large-volume, lower-priced commodity petrochemicals that comprise the bulk of Canada's exports. In spite of the start-up of additional world-scale facilities in 1984, small trade deficits in petrochemicals occurred in 1984 and 1986.

The total industry had before-tax losses of more than \$1.7 billion (\$1.1 billion after-tax) in the five-year period 1982-1986. The recovery which started in 1986 continued strongly in 1987 as world supply/demand came closer into balance and product prices continued to improve. While detailed statistics are not yet available, the industry achieved profitability in 1987.

#### CANADIAN PETROCHEMICAL INDUSTRY STATISTICS

Current \$ Millions	1982	1983	1984	1985	1986
Gross investment	7 355	7 729	8 326	8 257	8 318
Long and short term debt	3 049	3 196	3 588	3 520	3 480
<b>Profit (Loss)</b>					
Before Interest, Taxes and Writeoffs	(7)	41	228	(129)	255
Before Taxes, after Interest and Writeoffs	(244)	(250)	(218)	(899)	(135)
After Taxes, Interest and Writeoffs	(129)	(124)	(132)	(520)	(173)

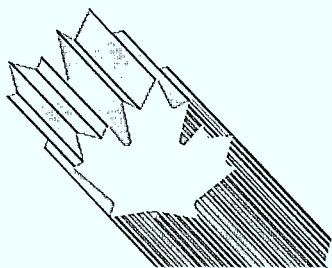
Source: *The Canadian Chemical Producers' Association (CCPA).*

## 2. Strengths and Weaknesses

#### Structural Factors

The petrochemical industry is feedstock and capital intensive. Hydrocarbons (oil and gas) are the major components in the cost of petrochemical production, representing 60 to 70 percent (raw materials plus energy). Capital (initial plant cost plus maintenance) accounts for 25 to 35 percent.

A strength of the Canadian industry is that, in large part, it has modern plants which are world-competitive in scale and technology. There are, however, some older plants, mainly in eastern Canada, which are less than world-scale.



Capital costs, however, are higher in Canada than on the U.S. Gulf Coast, where the major competition is located. Reasons include climate and lack of industry concentration. In addition, in Alberta the provincial "stepping-out" policy has required new plants to locate away from large metropolitan areas. When much of the existing industry was built (late 1970s/early 1980s) the capital cost disadvantage ranged from 15 percent in eastern Canada to about 25 percent in western Canada. While the Canadian disadvantage has been reduced in recent years due to economies in capital investment costs, it is probably still in the five to 15 percent range.

The relatively small, widely dispersed domestic market results in transportation cost penalties and a much higher export component for world-scale Canadian plants than for those located on the U.S. Gulf Coast. Transportation cost penalties also apply to the export component.

In trying to attract new investment, Canadian producers would have to offset the capital and freight disadvantages by some advantage(s) such as, for instance, a hydrocarbon cost advantage. Falling international energy prices and energy deregulation in Canada, however, have eliminated (oil-based) or drastically reduced (gas-based) the hydrocarbon cost advantage that Canadian petrochemical producers had enjoyed.

Feedstock flexibility allowing the use of natural gas liquids (NGL) as well as oil-based feedstocks has been suggested as a way for eastern oil-based ethylene producers to restore competitiveness. Polysar and Pétromont have been pursuing such a course.

#### Trade-related Factors

Tariffs are a significant factor in petrochemical trade. Rates generally increase the more the product is upgraded (methanol is a notable exception). Examples of rates for the large-volume chemicals produced in Canada are shown in the following table:

#### TARIFFS ON SELECTED CANADIAN-PRODUCED PETROCHEMICALS

January 1, 1988	Canada	U.S.	E.C.	Japan
Primary				
Ethylene	Free	Free	Free	5.8%
Methanol	10%	18%	13%	3.9%
Intermediates				
Styrene	7.5%	7.4%	6%	6.4%
Ethylene dichloride	10%	1.3¢/kg. + 3%	12%	5.8%
Ethylene glycol	10%	12%	13%	9.6%
Polyethylene	10.2%	12.5%	12.5%	22.4 yen/kg

Non-tariff barriers have not been significant in petrochemical trade.

Tariff elimination is the main element of the Canada-U.S. Free Trade Agreement (FTA) of significance to petrochemicals. While Canadian industry favoured immediate removal, the agreement provides for the tariffs on most petrochemicals to be phased out in five equal annual reductions, starting January 1, 1989. A limited number of low-volume products will be subject to a ten year phase-out.

#### Technological Factors

The industry operates, in the main, on imported technology which is freely available under licensing agreements. Polysar (synthetic rubbers) and Du Pont Canada (polyethylene) are examples of companies using Canadian-developed technology which also is licenced internationally. Modifications in the order of \$250 million per year are made on an ongoing basis to keep the plant and process technologies up to date.

The chemical industry has R&D expenditures of about 1.1 percent of sales. The Petrochemical Industry Task Force, in its 1984 report, commented on the type of R&D expenditures made by the petrochemical sector as follows:

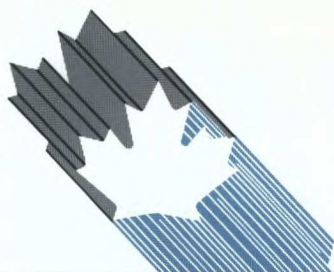
"Much of the industry's research and development is concentrated on providing technical support to customers and this, in turn, stimulates a high degree of innovation in downstream manufacturing sectors. Much of this work involves transferring technology and assisting in developing applications and new products. This is an essential part of the development process in R&D that is required to bring innovative products to the market. Although highly technical in nature, these efforts do not always fall under the government's definition of research and development. Therefore, the bulk of funding in the industry is internally generated and access to government incentives is relatively restricted."

While the federal government provides about 10 percent of the total of manufacturing industries' R&D expenditures, the federal contribution to the chemical products sector has been about 2.6 percent.

#### Other Factors

Exchange rate fluctuations can have a significant impact upon the profitability of existing facilities, particularly for export-oriented plants utilizing cost-of-service contracts for raw material supplies. Under energy decontrol, and in the absence of tariffs, exchange rate considerations will not play a major role in decisions relative to future Canadian investments.





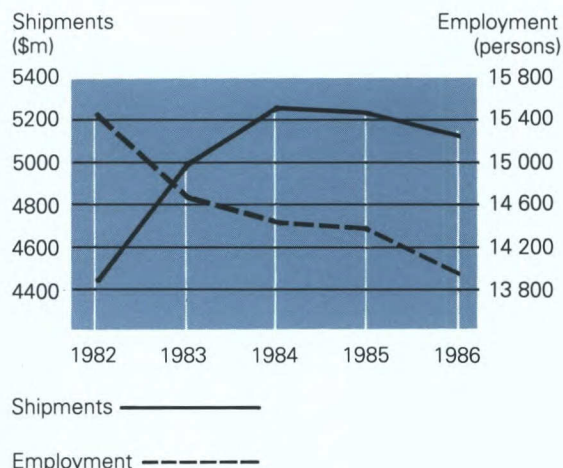
### 3. Evolving Environment

The lower international oil prices that have existed since early 1986 have resulted in stronger growth in worldwide petrochemical consumption. The increase in demand has resulted in moderate price increases for almost all petrochemical products. The Canadian industry, which suffered severe financial losses in the 1982-1986 period, is now operating at close to capacity, benefiting from a strong world demand and the weak North American currencies.

Worldwide operating rates are above 90 percent on most products, the industry norm that traditionally has led to new investment. Pricing, however, is still, in general, too low to justify the higher capital costs of new investments. Still-higher prices would be required to attract the new capacity needed by the early 1990s. In the absence of any significant economic downturn, existing producers should enjoy several years of profitable operation.

With an easing of the concerns over energy supply and the recent dramatic reductions in international crude oil prices, it is likely that much of the increased petrochemical capacity that will be required by the early 1990s will locate, according to traditional patterns, in the established industrialized countries. Energy-rich lesser-developed countries (LDCs) may still be able to attract some investment if they are prepared to offer substantial discounts from international energy prices. However, it is likely that the less-developed and newly industrialized countries will play only a minor role in the next round of capacity increases, essentially to satisfy their own domestic requirements.

Tax Reform has moved generally to reduce tax rates and broaden the tax bases of corporations. While corporate tax payments will generally rise to fund personal tax reductions, some corporations will experience tax reductions, while others will have increases. The Canadian Chemical Producers' Association has expressed the concern that the proposed put-in-use rule and the reduction in the write-off rate for manufacturing machinery and equipment may reduce their ability to compete for new projects with the United States. This concern has been responded to in part by the modifications to lessen the impact of the put-in-use rule on longer lead-time projects.



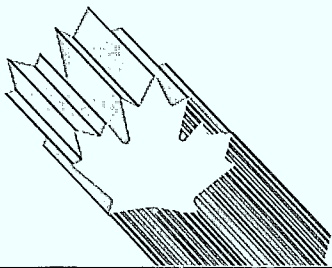
**Total Shipments and Employment**

The FTA will have different impacts upon the gas-based and oil-based segments of the petrochemical industry.

For the existing, export-oriented, western, gas-based sector, tariff elimination will mean improved profitability and competitiveness. Net return on existing U.S. sales will increase, while some offshore sales will be diverted to the more profitable U.S. market. Tariff elimination will also improve the prospects for further gas-based investments in Alberta to serve the North American market.

As well, tariff elimination could provide growth opportunities for the currently domestic market-oriented eastern producers of ethylene and derivatives to serve the expanded Canadian and northeastern U.S. markets. In addition, there could be investment opportunities for a range of aromatic products where the historically higher U.S. tariffs have prevented access to the U.S. market.

The increased competition that will result from the elimination of Canadian tariffs is likely to hasten the shutdown of older, less than world-scale production facilities, for the most part non-ethylene based, located mainly in eastern Canada. For some oil-based producers, the simultaneous phasing out of U.S. tariffs will provide the opportunity to replace the old facilities with modern world-scale plants to supply the domestic and U.S. markets. For others, the Canadian market will be supplied by U.S. producers.



#### 4. Competitiveness Assessment

After several years of losses, the Canadian industry is now profitable and stands to become more profitable as product prices worldwide increase to levels that will justify building the new capacity that will soon be required.

From a long-term perspective based on comparative return on investment, the Canadian petrochemical industry overall has not been as competitive as U.S. Gulf Coast facilities. Existing oil-based and gas-based ethylene and ethylene derivative facilities will, however, be in a good competitive position, relative to any new, higher-cost plants that will have to be built to supply increased petrochemical demands.

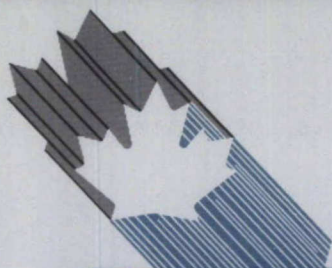
Overall, the FTA will have a positive impact on the industry. The elimination of tariffs will increase profitability on existing exports and will open up the U.S. market to a range of oil-based products now excluded by high tariffs. Investment prospects for additional facilities to supply the North American market have been improved. These opportunities will include products based on competitively priced, primary petrochemicals such as propylene and the aromatics.

For further information concerning the subject matter contained in this profile, contact:

Resource Processing Industries Branch  
Department of Regional Industrial Expansion  
Attention: Petrochemicals  
235 Queen Street  
Ottawa, Ontario  
K1A 0H5

(613) 954-3083





PRINCIPAL STATISTICS

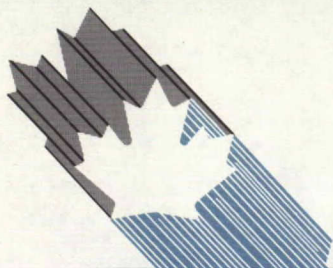
SIC(s) COVERED: 3712 and 3731\*

	1973	1982	1983	1984	1985	1986
Establishments		61	57	52	52	52
Employment	9 143	15 455	14 653	14 438	14 387	13 962
Shipments — including inter-mediates (current \$ millions)	641	4 434	4 992	5 258	5 220	5 114
Gross investment (\$ millions)	1 138	7 355	7 729	8 326	8 257	8 318
Profits after tax (\$ millions)	—	(129)	(124)	(132)	(520)	(173)
(% of sales)	—	(3.7)	(3.2)	(3.4)	(12.5)	(4.0)

TRADE STATISTICS

	1973	1982	1983	1984	1985	1986
Exports (\$ millions)	129	1 368	1 556	1 645	1 943	1 770
Domestic end-product shipments (\$ millions)	417	2 074	2 313	2 279	2 221	2 509
Imports (\$ millions)	334	1 043	1 475	1 693	1 734	1 852
Canadian market (\$ millions)	751	3 117	3 788	3 972	3 955	4 361
Exports as % of sales	24	40	40	42	47	41
Imports as % of domestic market	45	33	39	43	44	42
Source of imports **			U.S.	E.C.	JAPAN	OTHERS
(% of total value)		1982	76.2	16.5	1.4	5.9
		1983	75.7	15.0	1.4	7.9
		1984	74.8	17.1	1.3	6.8
		1985	71.0	19.4	1.7	7.9
		1986	71.4	19.1	1.9	7.6
Destination of exports **						
(% of total value)		1982	52.8	20.2	5.8	21.2
		1983	56.3	15.7	8.4	19.6
		1984	57.8	14.0	9.5	18.7
		1985	57.5	11.0	8.7	22.8
		1986	56.0	12.2	7.1	24.7



**REGIONAL DISTRIBUTION — Average over the last 3 years**

	Atlantic	Quebec	Ontario	Prairies***	B.C.
Establishments — % of total	nil	16.9	65.0	15.5	2.6
Employment — % of total ****	—	—	—	—	—
Shipments — % of total	nil	15.0	59.0	24.0	2.0

**MAJOR FIRMS**

Name	Ownership	Location of Major Plants
1. Polysar	100% Cdn.	Sarnia, Ontario
2. Dow	100% U.S.	Fort Saskatchewan, Alberta Sarnia, Ontario
3. Novacor Chemical	100% Cdn.	Joffre, Alberta Medicine Hat, Alberta. Sarnia, Ontario
4. Union Carbide	75% U.S.	Montréal East, Quebec Prentiss, Alberta
5. Du Pont	73% U.S.	Sarnia, Ontario Maitland, Ontario
6. Shell	79% Dutch	Sarnia, Ontario Montréal, Quebec Scotford, Alberta

\* While SIC 3712 and 3731 include all petrochemicals, they also include non-petrochemicals. There is no Statistics Canada category "Petrochemicals". Most data shown are from the CCPA which represents more than 90 percent of Canadian producers.

\*\* Chemicals Directorate Statistical Review SICs 3712 and 3731

\*\*\* Alberta accounts for all Prairies figures.

\*\*\*\* Accurate data not available. Employment would approximate to establishment distribution.



# Regional Offices

## Newfoundland

Parsons Building  
90 O'Leary Avenue  
P.O. Box 8950  
ST. JOHN'S, Newfoundland  
A1B 3R9  
Tel: (709) 772-4053

## Prince Edward Island

Confederation Court Mall  
Suite 400  
134 Kent Street  
P.O. Box 1115  
CHARLOTTETOWN  
Prince Edward Island  
C1A 7M8  
Tel: (902) 566-7400

## Nova Scotia

1496 Lower Water Street  
P.O. Box 940, Station M  
HALIFAX, Nova Scotia  
B3J 2V9  
Tel: (902) 426-2018

## New Brunswick

770 Main Street  
P.O. Box 1210  
MONCTON  
New Brunswick  
E1C 8P9  
Tel: (506) 857-6400

## Quebec

Tour de la Bourse  
P.O. Box 247  
800, place Victoria  
Suite 3800  
MONTRÉAL, Quebec  
H4Z 1E8  
Tel: (514) 283-8185

## Ontario

Dominion Public Building  
4th Floor  
1 Front Street West  
TORONTO, Ontario  
M5J 1A4  
Tel: (416) 973-5000

## Manitoba

330 Portage Avenue  
Room 608  
P.O. Box 981  
WINNIPEG, Manitoba  
R3C 2V2  
Tel: (204) 983-4090

## Saskatchewan

105 - 21st Street East  
6th Floor  
SASKATOON, Saskatchewan  
S7K 0B3  
Tel: (306) 975-4400

## Alberta

Cornerpoint Building  
Suite 505  
10179 - 105th Street  
EDMONTON, Alberta  
T5J 3S3  
Tel: (403) 420-2944

## British Columbia

Bentall Tower IV  
Suite 1101  
1055 Dunsmuir Street  
P.O. Box 49178  
Bentall Postal Station  
VANCOUVER  
British Columbia  
V7X 1K8  
Tel: (604) 666-0434

## Yukon

108 Lambert Street  
Suite 301  
WHITEHORSE, Yukon  
Y1A 1Z2  
Tel: (403) 668-4655

## Northwest Territories

Precambrian Building  
P.O. Box 6100  
YELLOWKNIFE  
Northwest Territories  
X1A 1C0  
Tel: (403) 920-8568

*For additional copies of this  
profile contact:*

*Business Centre  
Communications Branch  
Department of Regional  
Industrial Expansion  
235 Queen Street  
OTTAWA, Ontario  
K1A 0H5*

*Tel: (613) 995-5771*