STUDY OF THE PETROCHEMICAL INDUSTRIES IN THE COUNTRIES OF THE NORTHERN PORTION OF THE WESTERN HEMISPHERE

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of the Tariff Act of 1930

Appendix A
The Petrochemical Industry
in Canada

Volume 2

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Appendix A

The Petrochemical Industry in Canada

CONTENTS

Page

Forword-- vii

Olefins:
  Present situation:
    Description and uses-- A-1
    Customs treatment--- A-2
    Structure of the industry--- A-2
    Technology-- A-5
    Government policies and involvement------------------------------- A-5
    Production-- A-7
    Trade--- A-9
    Consumption--- A-10
  Future:
    Expansion plans--- A-11
    Demand-- A-13
    Trade--- A-15

Aromatics:
  Present situation:
    Description and uses-- A-17
    Customs treatment--- A-17
    Structure of the industry--- A-18
    Technology-- A-19
    Government policies and involvement------------------------------- A-20
    Production-- A-20
    Trade--- A-21
    Consumption--- A-24
  Future:
    Expansion plans--- A-26
    Demand-- A-27
    Trade--- A-29

Miscellaneous acyclic organic chemicals:
  Present situation:
    Description and uses-- A-31
    Customs treatment--- A-33
    Structure of the industry--- A-33
    Technology-- A-34
    Government policies and involvement------------------------------- A-34
    Production-- A-35
    Trade--- A-37
    Consumption--- A-37
  Future:
    Expansion plans--- A-39
    Demand-- A-39
    Trade--- A-41

CONTENTS

Page

Cyclic intermediates:
Present situation:
Description and uses---------- A-43
Customs treatment---------- A-43
Structure of the industry---------- A-44
Technology---------- A-46
Government policies and involvement---------- A-46
Production---------- A-46
Trade---------- A-47
Consumption---------- A-47
Future:
Expansion plans---------- A-48
Demand---------- A-49
Trade---------- A-50
Pesticides:
Present situation:
Description and uses---------- A-53
Customs treatment---------- A-53
Structure of the industry---------- A-54
Technology---------- A-55
Government policies and involvement---------- A-56
Production---------- A-56
Trade---------- A-57
Consumption---------- A-58
Future:
Expansion plans---------- A-58
Demand---------- A-59
Trade---------- A-60
Anhydrous ammonia and nitrogenous fertilizers:
Present situation:
Description and uses---------- A-63
Customs treatment---------- A-63
Structure of the industry---------- A-63
Technology---------- A-63
Government policies and involvement---------- A-64
Production---------- A-64
Trade---------- A-64
Consumption---------- A-65
Future:
Expansion plans---------- A-65
Demand---------- A-65
Trade---------- A-66

CONTENTS

Page

Synthetic rubber:
Present situation:
Description and uses---------- A-67
Customs treatment---------- A-68
Structure of the industry---------- A-68
Technology---------- A-69
Government policies and involvement---------- A-69
Production---------- A-69
Trade---------- A-70
Consumption---------- A-71
Future:
Expansion plans---------- A-71
Demand---------- A-72
Trade---------- A-73
Manmade fibers from petrochemicals:
Present situation:
Description and uses---------- A-75
Customs treatment---------- A-75
Structure of the industry---------- A-76
Technology---------- A-77
Government policies and involvement---------- A-78
Production---------- A-78
Trade---------- A-79
Consumption---------- A-80
Future:
Expansion plans---------- A-81
Demand---------- A-81
Trade---------- A-82
Cellulosic fibers:
Present situation:
Description and uses---------- A-83
Customs treatment---------- A-83
Structure of the industry---------- A-83
Technology---------- A-83
Government policies and involvement---------- A-84
Production---------- A-84
Trade---------- A-85
Consumption---------- A-85
Future:
Expansion plans---------- A-85
Demand---------- A-85
Trade---------- A-86

CONTENTS

Page

Plastics:
- Present situation:
  - Description and uses---------- A-87
  - Customs treatment---------- A-88
  - Structure of the industry---------- A-89
  - Technology---------- A-91
  - Government policies and involvement---------- A-91
  - Production---------- A-92
  - Trade---------- A-93
  - Consumption---------- A-94
- Future:
  - Expansion plans---------- A-95
  - Demand---------- A-97
  - Trade---------- A-99

Other petrochemical derivatives:
- Present situation:
  - Description and uses---------- A-103
  - Customs treatment---------- A-104
  - Structure of the industry---------- A-105
  - Technology---------- A-105
  - Government policies and involvement---------- A-106
  - Production---------- A-106
  - Trade---------- A-108
  - Consumption---------- A-113
- Future:
  - Expansion plans---------- A-113
  - Demand---------- A-114
  - Trade---------- A-115

Tables

A-1 - Olefins: Canadian rates of duty by tariff number---------- A-119
A-2 - Ethylene: Canadian production, imports, exports, and apparent consumption, 1975-79---------- A-120
A-3 - Propylene: Canadian production, imports, exports, and apparent consumption, 1975-79---------- A-121
A-4 - Aromatic hydrocarbons: Canadian rates of duty, by tariff number-- A-122
A-5 - Selected miscellaneous acyclic organic chemicals: Canadian rate of duty by tariff number---------- A-123
A-6 - Miscellaneous acyclic organic chemicals: Canadian imports, by functional group, 1975-79---------- A-124
A-7 - Cyclic intermediates: Canadian rate of duty, by tariff number---- A-126
A-8 - Pesticides: Canadian rate of duty, by tariff number---------- A-127

CONTENTS

Page

A-9 - Nitrogenous fertilizers: Canadian rate of duty, by tariff number-- A-128
A-10 - Nitrogenous fertilizers: Canadian production, imports, exports, and apparent consumption, 1975-79------------------------------- A-129
A-11 - Anhydrous ammonia: Canadian production, imports, exports, and apparent consumption, 1975-79----------------------------------- A-130
A-12 - Urea: Canadian production, imports, exports and apparent consumption, 1975-79--- A-131
A-13 - Ammonium nitrate: Canadian production, imports, exports, and apparent consumption, 1975-79----------------------------------- A-132
A-14 - Ammonium sulfate: Canadian production, imports, exports, and apparent consumption, 1975-79----------------------------------- A-133
A-15 - Nitrogen solution: Canadian production imports, exports, and apparent consumption, 1975-79----------------------------------- A-134
A-16 - Other nitrogenous fertilizers: Canadian production, imports, exports and apparent consumption, 1975-79----------------------- A-135
A-17 - Synthetic rubber: Canadian rate of duty, by tariff number-------- A-136
A-18 - Synthetic rubber: Canadian production, imports exports, and apparent consumption 1975-79------------------------------------ A-137
A-19 - Manmade fibers from petrochemicals: Canadian production, foreign trade, apparent consumption, and ratio of imports to consumption, 1975-79-- A-138
D-20 - Cellulosic manmade fibers, including filament yarn: Canadian production, imports, exports, and apparent consumption, 1975-79---- A-139
D-21 - Cellulosic manmade fibers, including filament yarn: Canadian imports and exports, by type, 1975-79-------------------------- A-140
A-22 - Selected synthetic plastics materials: Canadian rate of duty, by tariff number-- A-141
A-23 - Synthetic resins and plastics materials: Canadian shipment, imports, exports, and apparent consumption, 1975-79------------- A-142
A-24 - Synthetic resins and plastics materials: Percentage distribution of Canadian shipments of key plastics products by volume, 1975-79-- A-143
A-25 - Polyethylene resins: Canadian shipments, imports, exports, and apparent consumption, 1975-79----------------------------------- A-144
A-26 - Polystyrene resins: Canadian shipments, imports, exports, and apparent consumption, 1975-79----------------------------------- A-145
A-27 - Polyvinyl chloride (PVC) resins: Canadian shipments and imports, 1975-79-- A-146
A-28 - Synthetic resins and plastics materials: Canadian ratios of imports to consumption, exports to shipments, and imports to exports, 1975-79-- A-147
A-29 - Polyethylene resins: Canadian ratio of imports to consumption exports to shipments, and imports to exports, 1975-79----------- A-148

CONTENTS

Page

A-30 - Polystyrene resins: Canadian ratio of imports to consumption, exports to shipments, and imports to exports, 1975-79 ----- A-149
A-31 - Polyvinyl chloride (PVC) resins: Canadian ratio of imports consumption, exports to shipments, and imports to exports, 1975-79 ----- A-150
A-32 - Synthetic resins and plastic materials: Ratios of Canadian imports from the United States to total Canadian imports, by product, 1975-79 ----- A-151
A-33 - Polyethylene resins: Percentage distribution of total Canadian imports to exports to the four major markets, and to Mexico, 1975-79 ----- A-152
A-34 - Selected petrochemical derivatives: Canadian rates of duty, by tariff number ----- A-153
A-35 - Selected surface-active agents: Canadian production, imports, and exports, 1975-79 ----- A-154
A-36 - Organic pigments (color lakes and toners): Canadian production, imports and exports, 1975-79 ----- A-155
A-37 - Carbon black: Canadian production, imports, and exports, 1975-79 ----- A-156
A-38 - Plastiazers: Canadian production, imports, and exports, 1975-79 ----- A-157
A-39 - Selected organic dyes: Canadian production, imports, and exports, 1975-79 ----- A-158
A-40 - Selected flavors: Canadian production, imports, and exports, 1975-79 ----- A-159

FOREWORD

In this volume the petrochemical industry of Canada is divided into the following sectors:

(1) Olefins
(2) Aromatics
(3) Miscellaneous acyclic organic chemicals
(4) Cyclic intermediates
(5) Plastics
(6) Anhydrous ammonia and nitrogenous fertilizers
(7) Synthetic rubber
(8) Manmade fibers from petrochemicals
(9) Cellulosic fibers
(10) Plastics
(11) Other petrochemical derivatives

Each of these sectors is described and analyzed in the general areas of description and uses, customs treatment, industry structure, technology, government impact, production, imports, exports, consumption, expansion plans, future demand, and trade.

OLEFINS
Present Situation

Description and Uses

Olefins are the basic materials used in the production of many chemical products intended for use by consumers and industry. The technological means used to produce olefins are basically identical in the United States, Canada, and Mexico.

Olefin feedstocks are obtained from natural gas and crude petroleum. Natural gas streams contain natural gas liquids (NGL's) such as ethane, propane, and butane, and crude petroleum can be refined into fractions such as naphtha and gas oil. All these feedstocks are used in the manufacture of the largest volume olefins which are ethylene, propylene, and butadiene.

The chemical properties for olefins are the same whether they are produced in the United States, Canada, or Mexico. Olefins are produced from the same feedstocks in all three countries; however, the emphasis may be greater on one feed over another due to its availability.

Ethylene is a flammable, colorless gas with a characteristic sweet odor and taste. Ethylene is used in the manufacture of many products and is derived from the process of cracking light hydrocarbons, or by cracking the heavier liquid hydrocarbons, naphtha and gas oil, obtained during the refining of crude petroleum.

The major end use for ethylene is plastics, which accounts for nearly 60 percent of the total annual market. The other 40 percent is divided among solvents, antifreeze, and other products.

Propylene is also a highly flammable, colorless gas used as a building block in the manufacture of other petrochemicals. It is produced during the process of refining crude petroleum, and manufactured as a co-product with ethylene in olefins plants. The major end uses for propylene are fibers which account for almost 60 percent of the total annual market, and solvents and other polymers, which account for the remaining 40 percent.

Butadiene is also a flammable, colorless gas with a mild aromatic odor. It is obtained during the process of dehydrogenation of butanes and butenes. Like propylene, butadiene is a co-product in the production of ethylene. The major end uses for butadiene are in the manufacture of tires and other rubber products. These uses account for over 75-80 percent of the total annual market. Nylon fibers, resins, and other finished goods account for the remaining 20-25 percent.

Butylenes are also flammable, colorless gases obtained by distillation of refinery gases. Butylenes are used in the production of gasoline, aldehydes, alcohols, and butadiene.

Customs Treatment

Tariff

The Canadian tariff system may be called "multi-preferential." Tariff preferences are afforded to incoming goods first on the basis of the membership of the exporting country in the British Commonwealth; these British Preferential countries are generally taxed less than non-Commonwealth nations. Following the British Preferential Tariff is the General Preferential Tariff (GPT), which is similar to the Generalized System of Preferences (GSP) in the United States. Countries eligible for the GPT face only marginally higher tariffs than British Commonwealth nations in the majority of cases.

The United States receives most-favored-nation (MFN) tariff status in the Canadian tariff system. These tariffs are less "lenient" than the British Preferential Tariff and the GPT and more lenient, or less "protectionist", than Canada's General Tariff, which applies to all non-preferred nations, with some possible exceptions.

Canada has traditionally depended upon tariffs rather than non-tariff barriers to protect its olefins industry. The rates of duty for butadiene, butylene, ethylene, and propylene are free for countries granted MFN status (see table A-1). Isoprene and tetrapropylene, also olefins, were previously dutiable at a MFN rate of duty of 14.3 percent AVE; however, during the Tokyo Round of the General Agreements GATT, Canada agreed to lower the duty on these products to 9.2 percent AVE.

Structure of the Industry

Ownership

The role of the Government in industry is more substantial in Canada than in the United States but is not as involved as in the case of Mexico. The Canadian Development Corporation (CDC), established in 1972, is a holding company of which the Government owns 68 percent, and private domestic or foreign-owned enterprises hold the other 32 percent. CDC is a privately managed corporation charged with the maintenance and management of the production of petrochemicals, pipelines, and refining operations, among other duties.

In 1976, Petro-Canada was established as the first nationalized oil company, as a result of the move toward greater Government involvement in resource development. Petro-Canada gained the operations of two major privately owned producers in 1978. 1/ Petro-Canada will become even more important in the future as a result of the Canadian Government's decision to increase Canadian ownership in the oil and natural gas industry. 2/ The following tabulation shows major holdings of CDC in petrochemicals: 3/

1/ Dean Rusk Center, Comparative Facts on Canada, Mexico, and the United States, 1979, pp. 94-95.
2/ Wall Street Journal, Oct. 29, 1980, p. 6.
3/ Ibid., p. 103.

Company	Percentage owned by CDC	Product
CDC Oil and Gas, Ltd.-----	100	oil and gas exploration, refinement and production
Petro-Canada--------------	100	oil
Subsidiary--------------	45	oil
Subsidiary--------------	48	oil

An agency of the Quebec Government, the General Investment Corporation (GIC), operates like CDC. GIC has recently completed a joint venture with two major U.S.-based subsidiaries to form a Montreal-based company which intends to double ethylene capacity in Ontario. 1/

In Canada, oil companies account for a substantial amount of the total annual production of olefins. The major source for olefins production is the cracking of NGL's although crude petroleum fractions such as naphtha and gas oil are also used.

Canadian oil companies are becoming more involved in the production of olefins. Chemical companies often form direct ties with oil companies in order to have a reliable source of hydrocarbons. The disposal of the fuel co-products production is the major reason most heavy liquid olefins plants are owned by oil companies or joint ventures between oil and chemical companies. Oil companies are more knowledgeable in the marketing and disposal of fuels than are chemical companies.

The leading producer of ethylene in Canada accounted for 34 percent of total annual capacity in 1979. The next three largest companies accounted for approximately 58 percent; the remaining producers accounted for 8 percent of total annual ethylene capacity. 2/

The leading firm producing propylene accounted for approximately 48 percent of the total annual capacity in 1979. The next two largest firms account for 18 percent and 15 percent with the other firms accounting for the remaining 19 percent. 3/ Data for butadiene was not available.

Capacity utilization for the production of ethylene increased from about 56 percent in 1977 to 81 percent in 1978. 4/ Capacity utilization for propylene increased from 38 percent in 1977 to 60 percent in 1978. The increases are due to new derivatives plants coming on stream in late 1977. 5/

1/ Chemical Marketing Reporter, Oct. 6, 1980.
2/ Government of Canada, Industry, Trade and Commerce, The Canadian Petrochemical Industry, Sector Profile, 1979.
3/ Ibid.
4/ Chemical Marketing Reporter, Aug. 13, 1979.
5/ Ibid.

As a result of abundant supplies of NGL's in Canada, most olefin production is based on ethane. Ethane yields almost 100 percent ethylene while naphtha and gas oil yield an estimated 60-70 percent ethylene along with co-products such as butadiene and propylene. There is, however, some Canadian olefin production based on naphtha.

Integration

CDC has the sole responsibility for the exploration for oil and natural gas. CDC Oil & Gas is a vertically integrated firm which explores for, produces, and refines crude oil as well as manufactures olefin derivatives.

Foreign investment

Total capital expenditures for all industries during 1980 are estimated at $64.9 billion, 12 percent higher than in 1979. American-owned companies in Canada are planning to spend $11.3 billion on plant construction and equipment in 1980, a 40 percent increase over 1979. 1/

In 1979, the petrochemical industry completed an investment program in excess of $2.5 billion dollars 2/ which will provide 1980 capacity double that of 1975. Based on owership it is estimated 3/ that over $1.5 billion came from Europe and the United States. Foreign investment as a percentage of gross investment (excluding residental construction) amounted to 20.5 percent in 1977-78, down from 23.5 percent in 1975-76. The United States and Canada are each other's largest sources of foreign direct investment. 4/ The United States has about $44 billion (converted from 1979 Canadian dollars) in direct and portfolio investment in Canada, and Canada holds about $7 billion here.

There are several U.S.-privately-owned subsidiaries operating in Canada. Several of these major multi-product firms operating in Canada produce olefins.

The Foreign Investment Review Agency decides the value of an industry to Canada and issues permits to wholly foreign-owned companies to begin production. There is no requirement that the Government own any percentage of a foreign-owned company.

Prime Minister Pierre Trudeau recently announced plans for the "Canadianization" of the American-controlled oil and gas industry facilities in Canada by pledging at least 50 percent Canadian ownership by 1990. 5/ Canada's oil and gas industry was almost completely foreign-owned in 1960 (predominantly by

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1/ Kenneth Fernandez, "Canada-Market Prospects Mixed due to Slipping Economy," Business America, July 28, 1980, p. 4.

2/ Report of the Consultative Task Force on Petrochemicals, June 1978, pp. 1 and 8.

3/ Staff estimates based on foreign ownership in excess of 80 percent.

4/ The Dean Rusk Center, op. cit., p. 55. Report of the Consultative Task Force, op. cit., p. 11.

5/ "Trudeau to Cut U.S. Share in Oil Industry," The Washington Post, Oct. 26, 1980, p. A-1.

the United States) but the plan now is to make Canadians full partners in the industry. This is expected to be accomplished by favoring Canadian companies with exploration and development grants, and tax credits. 1/

Technology

Processes used in the production of olefins are the same in Canada as they are in the United States. Canadian technology status is equivalent to that of the United States. The major source of ethylene in Canada is the cracking of hydrocarbons derived from petroleum or natural gas streams. NGL's are the preferred feedstocks used in Canada.

In the Canadian chemical industry, nearly all R.& D. work is done by the parent firm. Since most Canadian chemical firms are U.S.-controlled, most new technological advances used in Canada were developed in the United States. In Canada only 37 percent of R.& D. is done by private industry. 2/

The Canadian Government, long dissatisfied with its performance in the area, has begun to take steps to correct this situation. In 1978, the Goverment announced plans to favor products and services with Canadian R.& D. content and to put emphasis on R.& D. commitments when reviewing new foreign investments. The Government also announced plans to increase R.& D. spending to 2.5 percent of GNP by 1985. 3/

Research and development in alternate feedstocks is among the top priority projects in Canada. The supplies of hydrocarbons are derived chiefly from natural gas; however, naphtha is considered an alternative.

Canadian firms are deeply involved in research into new sources of hydrocarbon feedstocks. Work on two proposed tar sands projects located in the resource-rich Western Provinces began with the intentions of providing additional sources of hydrocarbon feedstocks. As discussed later, these projects have been temporarily halted.

Government Policies and Involvement

Some current Canadian Government involvements in Foreign Direct Investment are: a review procedure, applied to foreign-based operations predating initial production; the value added tax (VAT) on manufacturing; special withholding treatment of dividend payments to residents outside Canada; and anti-trust, labor, dumping, patent, and trademark laws, some of which are more stringent and others which are more lenient than their U.S. counterparts.

Perhaps the most significant example of recent Government commercial policymaking in Canada is the movement toward "nationalism" in Canadian

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1/ Ibid.

2/ Statistics Canada, Canada Yearbook 1976-77, Canada, 1977, p. 435.

3/ Investing, Licensing, and Trading Conditions Abroad, Canada section, 1980 Business International Corp., January, 1980, p. 22.

industry, announced by Prime Minister Trudeau. 1/ The nationalistic policy is aimed at strengthening the Canadian grasp on businesses within Canadian borders. This nationalistic stance will probably have important consequences in the area of restrictions on foreign direct investment (FDI). While existing FDI regulations in Canada are numerous, they do not constitute strong barriers to entry or operation.

At any rate, in recent years Canada moved to increase its own involvement in the petrochemical industry. In 1978, the Canadian Federal and Provincial Governments established, among others, the Consultative Task Force in Petrochemicals to formulate recommendations that would lead to (1) adequate profitability levels and (2) effective utilization of available natural resources (oil and natural gas) to supplant imports and achieve a positive trade balance.

The Petrochemical Task Force studied the situation and made a number of recommendations. Among other things, it urged that (1) less petroleum be exported as is and more be utilized in the production of downstream products; (2) investment tax credits be expanded; (3) bilateral trade agreement be made with the United States for a limited group of petrochemicals; (4) Government regulation be analyzed for socio-economic impact before adoption; and (5) nationalization or direct government participation be limited or eliminated in areas where the private sector has demonstrated its ability to perform in the public interest.

The Government is deeply involved in the operations of Canada's oil and gas industry. In the future, as Petro-Canada's involvement increases, its influence in petrochemicals will also grow.

Canada is not as protectionist as Mexico which is illustrated by the duty-free status for most olefins imports into Canada. Export barriers do occur in the petroleum industry as part of the effort to promote energy independence. The Canadian Government closely restricts exports of oil and natural gas to the United States and there have been plans to phase out all oil exports to the United States.

Government-industry relationship

Actions of the Government of Canada impact heavily the production of olefins. The Foreign Investment Review Agency operates to secure the best interests of the nation and to help promote a sense of nationalism. There are also laws governing dumping, value-added taxes, and countervailing duties. The Government does not, however, extend any obstacles to foreign investment which would discourage a company from beginning operations. This ease-of-entry situation may change as a result of the recent Canadian decision to further "Canadianize" the oil and gas industry.

The Government fully owns one petrochemical plant and controls percentages of other companies via CDC. The Government is, in some instances, in business with U.S.-based subsidiaries operating in Canada.

1/ The Wall Street Journal, June 18, 1980, p. 1.

Corporate tax rates and higher capital cost allowances are lower in Canada than in the United States. There is a potential Canadian taxation advantage sufficent to offset an 11 percent capital cost disadvantage provided the company earns enough profit to take full advantage of the allowance in the year it is available. 1/ In practice, this has not been generally possible either because of the sheer magnitude of investments relative to ongoing profits by existing companies, or because new companies have been incorporated. Because of this, the potential Canadian taxation advantage has frequently been voided. 2/ Again, much of the above will change in the future, particularly in the case of the oil and gas industry.

The Canadian Government has announced its plans to develop the Alberta tar sands which could effect future feedstock availability. In 1980, the Federal Energy Minister of Canada announced a major program to increase natural gas use in Quebec and to restructure Eastern Canada's refining industry in order to minimize production of residual fuel. This change in Eastern fuel markets would create "a net addition to (Canada's) fuel supply equivalent to a $6-billion tar sands plant . . . but at half the cost and three years sooner." 3/

This means that the policy to reach world price equivalence for the tar sands has been changed. Canada is trying to enforce a system that would equalize costs for crude oil. Canada's oil industry is 75 percent foreign-owned (by U.S. firms) and Canada hopes to increase its ownership to 50 percent by 1985. 4/ This is still part of the plan to make Canada energy self-sufficient.

Production

As a result of the energy crisis and an awareness of its oil and gas feedstock reserves, Canada constructed several world-scale olefins plants and unit expansions. In 1977 and 1978, both naphtha-based and ethane-based plants were built.

Until 1977, Canadian production of ethylene was approximately equivalent to that consumed in the production of ethylene derivatives. In 1978, one major Government-owned company increased output of ethylene and in 1979, a large olefins plant came on stream. Production of ethylene in 1975 reached approximately 944 million pounds, increasing to 1 billion pounds in 1976. Between 1976 and 1979, production of ethylene increased by an estimated 38 percent (see table A-2).

Canadian production of propylene increased from 405 million pounds in 1975 to 537 million pounds in 1976 and to 915 million pounds in 1979, (table A-3).

Data for Canadian production of butadiene were not available. In 1978, Canadian producers upgraded the use of crude-oil feedstocks such as naphtha

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1/ The Government of Canada, Industry, Trade and Commerce, The Petrochemical Industry, June 1978, p. 5.
2/ Ibid.
3/ Chemical Week, May 28, 1980, p. 16.
4/ The Wall Street Journal, June 18, 1980.

and refinery gases in the production of olefins. An estimated total of 1.9 million barrels per day of crude oil was used with 4 percent going into the production of olefins and increasing future production of butadiene. 1/

The largest producer of olefins in Canada utilizes ethane extracted from natural gas. Natural gas is also viewed as the best source of olefins feedstocks in the future. By 1976, twice as much natural gas had been discovered in the Province of Alberta as was being consumed. 2/ Supplies of natural gas feedstocks are abundant in the province of Alberta. A major Alberta plant produced enough ethylene in 1979 to service Western Canada as well as the Pacific Coast United States. 3/ Sufficient supplies of ethane are available in Western Canada for at least two or three more world-scale plants. 4/

During the period 1976 to 1978 propane production increased by 12 million barrels and butane production increased by 7 million pounds at one plant site. 5/ Another plant increased its production of propane by almost 18 percent. 6/ During the same period, a U.S.-based subsidiary plant doubled its propane production. 7/

As the price of oil increased, prices for feedstocks rose. Natural gas was priced at "85 percent of the energy equivalent of crude oil at Toronto." 8/ This maintains the price of natural gas below the levels in many producing and consuming nations.

Canada's hydrocarbon reserves are summarized in the following tabulation: 9/

1/ W. Norman Kissick, "Petrochemicals," Canada's Chemical Industry, Feb. 17, 1979.
2/ "Petrochem Units Will Have Firm Base," Canadian Chemical Processing, vol. 61, no. 9, Sept. 1977.
3/ Ibid.
4/ Ibid.
5/ Ibid. p. 26.
6/ Ibid.
7/ Ibid.
8/ Douglas Jackson, "Energy, the 1979 Perspective," prepared for presentation at the First Annual Canadian Outlook Conference on Resin Supply and Demand, Toronto, Ontario Nov. 15, 1979, p. 7.
9/ B.S. Withers, "Interrelationships of Feedstocks," prepared for presentation at the First Annual Canadian Outlook Conference on Resin Supply and Demand, Toronto, Ontario, Nov. 15, 1979.

Source	Years of supply
Crude oil	10
Tar sands	100
Natural gas	35
Potential natural gas	35-100

Proven reserves of Canadian crude oil are expected to last another 10 years and proven reserves of natural gas for an additional 35 years. There is, however, a potential 35 to 100 years of additional supply of natural gas and crude petroleum largely dependent upon new discoveries in the resource-rich areas of Alberta and the Canadian frontier.

An alternative potential source of feedstock which could play an important role in future hydrocarbon availability are the Alberta tar sands. Resources extracted from the Alberta tar sands are expected to yield approximately 100 years of hydrocarbon feedstock supply. 1/

As the world price of oil and gas continues to increase, and as world fossil fuel supplies abate, countries in the industrialized world will turn to other energy sources such as nuclear, hydro, and solar, and to other sources of fossil fuels such as tar sands, oil shale, and so forth. Canada is in a particularly favorable position with respect to these future energy supplies, with large deposits of oil and natural gas, nuclear fuels, and other fossil fuels, particularly oil sands, which will become relatively more economical to extract as the years pass. Presently and into the foreseeable future, Canadian energy and feedstock supplies will be adequate for both domestic consumption and to a substantial degree for exports as well.

Trade

Most of Canada's olefins trade is with the United States, and the Canadian goal has been to increase the volume of olefin exports through several trans-national corporations. In 1978, approximately 68 percent of Canada's olefin imports come from the U.S. and 85 percent of the olefin exports found markets in the U.S.

Imports

The gap between production and demand for olefins had been filled by imports until 1978. Imports of ethylene increased from 40 million pounds in 1975 to 119 million pounds in 1977 (see table A-2). In 1978, imports of ethylene decreased to 11 million pounds as a result of new plants coming on stream.

1/ Ibid.

In 1977, 31 percent of all imported ethylene came from the United States. In 1978, close to 100 percent of the ethylene imports into Canada originated in the United States.

Imports of propylene were negligible until 1978 at which time they increased to 44,000 pounds in response to an increase in demand for propylene derivatives (see table A-3). Production of propylene in Canada has been sufficient to meet domestic demand since 1978.

Canada intends to continue decreasing the amount of olefins imported. And with world-scale facilities now on stream and future construction planned this goal should be attainable.

Exports

Prior to 1978, Canada was in the practice of exporting ethylene and importing ethylene derivatives, however, in 1978, several ethylene derivative plants began operations. Exports of ethylene in 1977 amounted to 11 million pounds and decreased to 4 million pounds in 1978 (see table A-2).

Exports of propylene increased from 88 million pounds in 1975 to 119 million pounds in 1976 and increased to 121 million pounds in 1977. By 1978, exports had almost tripled the 1977 level as a result of several new plants coming on stream (see table A-3). All of the exported propylene found markets in the United States.

In order to justify more world-scale olefins plants, Canada has been seeking more export markets. Canada is essentially self-sufficient in reserves of both oil and gas and is exporting larger and larger quantities of olefins. It would also like to export increasing quantities of olefins derivatives.

At the center of Canada's export market are the Alberta Province plants. Over 80,000 barrels per day of ethane are extracted in Alberta with almost 40 percent of this feed going into the production of 1.2 billion pounds of ethylene per year.

Consumption

From 1975-1978, Canada's per capita consumption of domestic ethylene was only half of that in the U.S. 1/ During this period, Canada relied heavily on ethylene and ethylene derivatives imports. Ethylene consumption steadily increased from 1975 to 1979. Demand for ethylene has been increasing at approximately 8 percent per year as production of ethylene derivatives increased. The percent of ethylene consumed by derivatives in 1978 is indicated below: 2/

1/ Chemical and Engineering News, July 14, 1980.
2/ "All Key Chemicals are in Good Supply," Canadian Chemcial Processing, vol. 62, No. 6, June 1978.

Ethylene	
Derivative	Percent of total consumption
Low-density polyethylene (LDPE)	38
High-density polyethylene (HDPE)	25
Ethylene oxide	13
Ethylbenzene	12
Ethylene dichloride	6
Other	6
Total	100

In 1976 the demand for propylene recovered from the effects of the recession and resulted in an increase in the production of polypropylene. In 1977 demand increased substantially due to derivative plants coming on stream. In 1978, consumption of propylene increased almost 25 percent due to a rise in polypropylene production. 1/ The percent of propylene consumed by derivatives is shown below: 2/

Propylene	
Derivative	Percent of total consumption
Oxo alcohols	24
Polypropylene	20
Propylene oxide	18
Isopropyl alcohol	12
Cumene	4
Other	22
Total	100

Future

Expansion Plans

Future Canadian olefin plant expansions are dependent upon continued growth in the domestic market and increased exports of olefins and/or derivatives. Presently, olefin feedstocks and fuel prices are relatively low and companies want to take advantage of this situation to build plants. Ethane supplies are presently adequate to serve additional plants or plant expansions.

1/ Ibid.
2/ Ibid.

Who, what, when, why, where

A large company located in Alberta is considering constructing two additional world-scale ethylene plants based on ethane. A joint venture is planned based on naphtha in order to supply ethylene and propylene to Eastern Canada. U.S.-based subsidiaries are involved in some of the Alberta projects.

Olefins plant construction and expansion will occur in the Province of Alberta due to the ready availability of feedstocks. Sarnia and Montreal are other areas expected to expand their olefins capacity because of their proximity to the largest Canadian markets.

The Canadian Federal Government has recently stopped work on the Alberta tar sands projects as a result of a dispute among the Provincial Governments concerning regulation and taxation of future olefins shipments. The dispute arose as a result of the Federal Government's belief that they alone have the Constitutional right to control resources passing from one province to another.

A consortium heads the proposed $8-billion Alsands tar sands plant which will produce synthetic crude oil from the tar sands. This project is expected to provide alternative feedstock sources for the production of olefins. If the projects are delayed much longer, there is the possibility of termination as a result of concern over the possible restructure of the tax schedule and royalty rate. 1/

Impact on industry

Since 1979, two major ethylene complexes came on stream boosting total annual Canadian ethylene production to 2.2 billion pounds per year. This will alter the future supply picture for ethylene. Prices for ethylene are expected to be close to those in the U.S. Gulf Coast area or even lower. Ethylene from Alberta will be piped to Sarnia and sold at commercial rates which are approximately equal to those in the Gulf Coast area. 2/

There are, however, certain disadvantages to building a petrochemical plant in Canada versus the U.S. Gulf Coast. The capital cost index is higher in Canada as illustrated below: 3/

Area	Capital cost
U.S. Gulf Coast	$1.00
Sarnia	1.20
Montreal	1.30
Alberta	1.35

1/ Chemical Week, Sept. 24, 1980, p. 18.
2/ The Government of Canada, Industry, Trade and Commerce, The Petrochemical Industry, June 1978, p. 4.
3/ The Government of Canada, Industry, Trade and Commerce, The Petrochemical Industry, June 1978.

The differences in cost in the three areas of Canada are primarily due to climate and availability of trained personnel.

Ethylene is expected to be in good supply until 1985. Usage is expected to grow by 7 to 9 percent per year with most of the output going into polymers. 1/

Propylene's expansion is tied to polypropylene and industrial solvents. Two major plants will be producing substantial quantities of propylene, in complexes to be completed in Sarnia by 1981. 2/

Several of these plant expansions will be joint ventures between the Government and one or more privately-owned firms. Capacity utilization is expected to remain low until Canada can secure more export markets for olefin derivatives. Exports of olefin derivatives are expected to find markets in the United States.

Feedstock availability is not a problem in Canadian expansion plans during the 1980's and horizontal and vertical integration are expected to increase as Canada becomes more and more self-sufficient and as domestic demand increases.

Demand

Canada intends to be able to satisfy domestic demand for olefins and derivatives and eliminate the need for imports by 1990. In the years since the Arab oil embargo, Canada has decided to make the move toward self-sufficiency in the manufacture of these petrochemicals.

Forecast growth

The demand for ethylene is expected to increase significantly during the 1980's. The completion of an ethylene facility in Alberta and plants for ethylene derivatives production are expected to result in a significant increase in ethylene consumption. Demand for ethylene is expected to increase by an annual rate of 8 percent from 1980-1985 and at an annual rate of 5 percent per year from 1985-1990. 3/ Exports of ethylene and ethylene derivatives are expected to increase as demand in the U.S. markets increases, especially if Canada can obtain duty-free access.

Demand for propylene is expected to increase at an annual growth rate of 4 to 5 percent from 1980-1985 and at an annual growth rate of 6 percent from 1985 to 1989 as a result of increases in demand for the propylene derivative polypropylene.

1/ Ibid.
2/ Ibid.
3/ The Government of Canada, Industry, Trade and Commerce, The Petrochemical Industry.

Reasons for growth

The reasons for growth in ethylene are expected increases in the production of LDPE, HDPE, ethylene oxide, and ethylbenzene. Plants producing these derivatives may be operating at close to nameplate capacity by 1984. The following tabulation contains forecasts of the total production in metric tons, of these ethylene derivatives by 1984: 1/

Derivative	Quantity (metric tons)
LDPE	470,000
HDPE	260,000
Ethylene dichloride	240,000
Ethylene oxide	230,000
Ethylbenzene	110,000
Other	45,000
Total	1,355,000

These demand levels assume that these derivatives will be consumed primarily in Canada and the surplus exported.

The reason for growth in propylene is an expected continued growth in polypropylene. The following table shows the forecast for the production of propylene derivatives by 1984: 1/

Derivative	Quantity (metric tons)
Polypropylene	149,000
Oxo alcohols	80,000
Isopropyl alcohol	68,000
Propylene oxide	52,000
Cumene	15,000
Other	61,000
Total	425,000

1/ The Government of Canada, Industry, Trade and Commerce, The Petrochemical Industry.

Relationship to U.S.

Canada is viewed as a reliable supplier of olefins and olefin derivatives to the United States. Canada's per capita consumption of olefins is only half as much as that in the United States. 1/ Canada has been importing large quantities of imported finished goods derived from olefin derivatives. In response, Canada has been expanding its olefin derivatives industry, therefore, a trade pact with the United States is seen as beneficial for Canada. Canada hopes to supply the U.S. with more olefin derivatives instead of only the raw materials needed to produce the derivatives.

Relationship to Mexico

Canada is a developed nation with a population of 23 million. Mexico, on the other hand, is a developing country with almost 3 times the population of Canada. 2/

Mexico and Canada both have abundant supplies of hydrocarbons, however, Canada is more in favor of free trade than Mexico who is more protective of its resources. Mexico could be a market in the future for Canada. Mexico has thus far been unable to satisfy its ever-increasing domestic demand, but plans to become more self-sufficient by the mid-1980's.

Trade

Future Canadian expansions are expected to satisfy domestic consumption as well as increase the volume of olefins and olefins derivatives exported and decrease the amount of derivatives imported into Canada.

Changes in imports and exports

The gap between olefins and derivatives demand and production has, in the past, been filled by imports. Self-sufficiency is the goal for the future. Prices of olefins imports are expected to increase during the period 1980-1990.

Alberta intends to pipe its surplus natural gas to olefins plants in Eastern Canada in order to decrease olefin imports there. Canada's industry is not yet able to supply all the olefins needed by the petrochemical industry; however, the newly completed and planned expansions are expected to change this pattern.

Canada does not want to rely solely on the United States as a market for its increased ethylene capacity. Canada plans to export about 60 percent of the Alberta plants' ethylene production either as olefins or derivatives to the United States by 1982. 3/ Future ethylene expansion in Alberta is planned

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1/ Chemical Marketing Reporter, Feb. 18, 1980.
2/ U.S. Department of Commerce, "World Population," 1979.
3/ Chemical Marketing Reporter, Feb. 18, 1980.

primarily for the production of ethylene for direct export or for conversion to derivatives for export. 1/

By 1985, Canada is expected to be a net exporter of petrochemicals. A growing market in the U.S. for olefin derivatives along with U.S. tariff concessions at the recently completed Tokyo Round of the Multilateral Trade Negotiations (MTN) for olefin derivatives will help make Canada a net olefins exporter. 2/

Likely new trading partners

Besides the traditional partner (the United States), Canada is looking toward Mexico and Japan as possible markets for its olefins and olefin derivatives. Expansions in Alberta in the production of olefins will be in excess of Canada's needs; therefore, the surplus will probably be directed to the U.S., Japan, and other nations in Southeast Asia.

Impacts on producers, consumers, and new uses

Supplies of feedstocks in Canada are more secure than in many other areas of the world. There are feedstock alternatives in the tar sands and new natural gas field discoveries.

Canada has sufficient supplies of feedstocks for olefins to supply the needs of domestic consumers through the end of the century. 3/ Canada's olefin prices are now relatively low due to price-controlled abundant feedstocks; however, they are expected to increase. The rate of olefin price increases is expected to be greater than the inflation rate such that by 1985 Canadian olefin prices would become equivalent to world prices. 4/

1/ Ibid.
2/ Predicasts, Prompt, Oct., 1979.
3/ Chemical Marketing Reporter, Feb. 18, 1980.
4/ Ibid.

AROMATICS

Present Situation

Description and Uses

The primary aromatics (BTX) produced in Canada are petrochemicals of the same chemical formulas and chemical and physical properties as their counterpart products in the United States. 1/ This holds true for the xylene isomer, para-xylene, and for naphthalene as well. 2/

In the United States, benzene, toluene, and the xylenes produced for chemical conversion are manufactured at specific degrees of purity (the reader is referred to the U.S. section of this study). Canadian aromatics are bought and sold, like U.S. aromatics, at different degrees of purity. Unfortunately, the purity breakdowns for sales, and so forth, are available only from individual firms producing and selling Canadian aromatics. 3/

Customs treatment

Tariff

Canadian tariffs on the primary aromatic hydrocarbons exported to Canada from the U.S. were formerly 15 percent ad valorem (see table A-4). With the completion of the Multilateral Trade Negotiations (MTN), BTX and p-xylene tariffs were cut to zero. Naphthalene from the U.S. is currently taxed at 14.3 percent ad valorem; this figure will fall to 9.2 percent ad valorem according to the following schedule:

Date	Duty rate (percent)
January 1, 1981------------	13.6
January 1, 1982------------	12.8
January 1, 1983------------	12.1
January 1, 1984------------	11.4
January 1, 1985------------	10.7
January 1, 1986------------	9.9
January 1, 1987------------	9.2

1/ Mixtures of isomers such as the xylenes may have slightly different properties depending upon the composition of the mixture. On the whole however, differences in the mixtures seldom are significant. BTX herein are also referred to as aromatics and primary aromatics.

2/ Currently, p-xylene is not produced in Canada.

3/ According to officials of the Canadian Chemical Producers' Association. The uses of aromatic hydrocarbons in Canada are much the same as uses in the United States. The reader is referred to the "Consumption" part of this section and to the U.S. section on "Description and uses" for further information on the uses of BTX, p-xylene, and naphthalene.

Non-tariff barrier

There are no known Canadian non-tariff barriers (NTB's) specifically designed to exclude primary aromatics, p-xylene, and/or naphthalene. Canadian Government procurement regulations, and the Canadian foreign direct investment stance, as well as other Canadian Government policies all have some effect on commercial aromatic hydrocarbon trade as NTB's. 1/

Structure of the Industry

Ownership and foreign investments

As of year-end 1979, there were eight producers of benzene in Canada. Six benzene producing firms were controlled at least partially by United States petroleum and/or chemical companies. 2/ These U.S.-controlled and partially-controlled benzene producing firms share or account for fully 75 percent of Canada's capacity to produce benzene, which currently stands at approximately 225 million gallons per year.

Most of the remainder of Canadian benzene capacity is shared by private Canadian and by Netherlands interests. The Canadian Government also shares in capacity for the production of benzene with a private firm.

Integration

BTX firms in Canada produce derivative petrochemicals, e.g. ethylbenzene and styrene, other aromatics, and other petrochemicals, constituting vertical integration. As well, many Canadian benzene producers are involved in ventures not related to petrochemical production and sales, constituting horizontal integration. One example is a Canadian petrochemical producer with interests in non-petroleum energy resources such as coal and uranium.

Other industry characteristics

The largest benzene-producing firm in Canada possesses about 20 percent of total Canadian capacity; the largest 4 firms possess approximately 70 percent of total capacity; Canada currently has eight benzene-producing firms.

Capacity utilization for Canadian benzene producing companies was approximately 65 percent in 1976. In 1977, capacity utilization for benzene dropped to 55 percent; in 1978, capacity utilization increased to over 70 percent. Figures for 1979 capacity utilization are not available.

1/ The reader is referred to the section on "Government policies and involvement" herein.

2/ These firms often produce toluene and mixed xylenes as well as benzene.

Most toluene producing companies in Canada in 1979 were U.S.-controlled or partially-controlled. 1/ The U.S. firms with interests in Canadian toluene production are large, vertically and/or horizontally integrated oil giants. 2/

The largest toluene producer in Canada currently owns 30 percent of Canadian capacity to produce toluene. The largest four firms possess 82 percent of Canadian capacity for toluene production. There are six toluene producing companies in the Canadian Commonwealth.

Capacity utilization for the Canadian industry producing toluene was approximately 25 percent in 1974. Capacity utilization has since that time grown to 50 percent in 1978, and stands to grow much further with the development of domestic and foreign markets.

Mixed xylenes production in Canada is likely to remain stable for several years; on the supply side, there is currently some overcapacity, while on the demand side exports have been and are likely to be an important market force, especially exports for gasoline anti-knock use. Mixed xylenes capacity is expected to grow somewhat from the 1979 level of 145-plus million gallons to 170-plus million gallons by the late 1980's.

Para-xylene is not produced in Canada and will probably not be consumed in the next few years. According to available information, naphthalene production is currently negligible or nil, although small amounts of naphthalene may be imported and consumed in the Commonwealth.

Technology Status

BTX process techniques are common to nearly all producing countries. The U.S.-based firms which have entered the Canadian market have brought with them the same methods of production as are used in the United States. The following table recounts an estimate of benzene, toluene, and xylenes sources in Canada in 1980 and projected Canadian benzene, toluene, and xylenes sources in 1985, by percents of overall production:

1/ The sole exception is a company (with an interest in Canadian toluene production) based in the U.S. but which is further a subsidiary of a foreign firm.

2/ Vertically, integration tends toward derivative petrochemicals, and so forth. Horizontally, interests are wide but include food products, fabrics, and so forth.

Source	Benzene		Toluene and xylenes
	Estimated 1980	Projected 1985	Estimated--early 1980's
Catalytic reformate	39	67	70
Pyrolysis gasoline	35	1/	25
HDA 1/	17	1/	-
Coal	9	1/	5

1/ Estimated.
2/ Hydrodealkylation.

Canada is moving toward expansion of research and development, both in manpower and in dollar investment expenditures. However, in areas such as BTX, p-xylene, and naphthalene, where technology has been pushed to the point that only marginal improvements are likely in the short term, Canadian and U.S.-based Canadian firms generally spend little time and money researching alternative technologies. Rather, investments are likely to be made on improving the efficiency of current technologies.

Production facilities

The Canadian Government may own or participate in the ownership of a business. In fact, one petrochemical producing company in Canada is 100 percent Government-owned. Another petrochemical firm, a producer of benzene, is partly owned by the Canadian Government, which shares ownership with two U.S. firms.

Government-industry relationship

The Canadian Government shares with the Federal Government of the United States a broad policy of commercial laissez faire, with respect to production, consumption, and import and export trade in goods and services alike. However, while laissez faire may be the rule, exceptions are numerous. Like every other industrialized nation for example, Canada enforces duties on imported goods. Only naphthalene is currently a dutiable item among those discussed in this chapter. While export controls are not applied to BTX, p-xylene, or naphthalene, there is precedent for such application in Canadian nuclear fuel materials exports among other exported products.

Production

Canadian production of benzene increased every year from 1975 to 1978. 1/ In 1975, production of benzene was approximately 78 million gallons, 50 percent of Canada's benzene production capacity in that year. After 1975, production

1/ Through 1978. Canadian production figures are not available for 1979.

increased by approximately 100 percent. In 1978, nearly 160 million gallons of benzene were produced, or 70 percent of Canada's benzene capacity that year. Capacity will likely level off until the early 1980's; production figures during that period will depend partially on the export market (especially to the United States) as well as on the general economic climate in Canada. Production of key benzene derivatives in Canada is another obvious determinant of Canadian production strength in benzene.

Toluene production in Canada grew from approximately 27 million gallons in 1975 to nearly 73 million gallons in 1978. 1/ This growth represented an average annual increase of 15-plus million gallons, or over 55 percent per year, using the 1975 production figure as a denominator. Production figures were almost identical in 1977 and 1978, and represented, respectively, 51 percent and 49 percent of toluene production capacity. As with benzene, Canadian toluene production in the early 1980's will depend heavily on the development of derivative markets, e.g. tolylene diisocyanate, and on the export market, including BTX anti-knock components demand in the United States.

The mixed xylenes capacity in Canada is somewhat greater than 145 million gallons currently. Production figures were not available at the writing of this chapter. Mixed xylenes capacity is expected to remain constant into the early 1980's. There is currently no p-xylene capacity and therefore no production of p-xylene in Canada. Neither is p-xylene consumed in Canada presently, nor is any consumption likely for at least a few years. It is believed that Canadian naphthalene capacity is negligible or nil.

Canadian feedstocks for the production of BTX, and other aromatic hydrocarbons 2/ are in relatively abundant supply. However, the price of feedstocks in Canada, as elsewhere, is rising and has been rising at an uncomfortable rate since the Arab oil embargo.

Trade

Aromatic hydrocarbons producers in Canada exported to the U.S. far more than Canadians imported U.S. aromatics in 1979.

In early 1978, forecasters predicted that, by 1980, Canadian manufacturers would absorb only 60 percent of domestic production of aromatics, down from 80 percent in 1977-78. 3/ To a not insubstantial degree, these predictions have come true. Export trade thus has become the primary road toward the goal of battling severe overcapacity. The need for exports came when a 10 percent per year growth rate in Canadian consumption, which was needed, was not achieved. Now, Canadians are especially counting on the 50 percent reduction in U.S. tariffs negotiated in the Tokyo Round, and higher U.S. feedstock prices, in developing petrochemical markets in the United States. 4/ The U.S. easily

1/ Through 1978. Canadian production figures are not available for 1979.

2/ Naphthalene production quantities are not known, but are believed to be small.

3/ PROMT, a Predicasts publication, Apr. 1, 1978, p. 152.

4/ Canadians have been faced with higher construction costs, inclement weather, and so forth, all of which have made competition with the U.S. petrochemical industry very difficult in past years.

represents Canadian petrochemical producers' largest market. Aromatics exports to the United States alone were over 137 million gallons in 1979.

Export figures for BTX are not published by the Canadians. Statistics on "hydrocarbons and derivatives" exports from Canada are published, however, and show that exports have far exceeded imports since 1976, both on a quantity basis and on a value basis. 1/ However, it should be noted that hydrocarbons and derivatives include a much greater representation of non-BTX, p-xylene, and naphthalene chemicals. Exports of hydrocarbons and derivatives almost tripled during 1976-79 (quantity basis). Import quantities grew irregularly from approximately 8 million gallons in 1976 to almost 15 million gallons in 1979. In Canadian dollars, exports of hydrocarbons and derivatives grew steadily from $91 million in 1976 to $475 million in 1979.

Imports

Imports of aromatics did not exceed Can$20 million during 1977-79. Imports of benzene to Canada were approximately 15 thousand gallons in 1975 and in 1976. Benzene imports increased sharply to 1.1 million gallons in 1977, fell to approximately 660 thousand gallons in 1978, and increased markedly in 1979 to 4.3 million gallons. In Canadian dollar terms, benzene imports increased without interruption from $12,000 in 1975 to $4.8 million in 1979.

Canadian imports of toluene increased steadily from about 2 million gallons in 1975 to almost 7 million gallons in 1979. In value terms, imports to Canada grew without interruption from approximately Can$1 million in 1975 to Can$7.4 million in 1979.

Imports of mixed xylenes plus the isomers to Canada fluctuated between 530 thousand gallons and 6.5 million gallons during the last half of the 70's decade. The year of lowest imports, i.e., 1975, was followed by the year of greatest imports, 1976. In 1977 and 1978, imports were in the area of 1.5 to 2.2 million gallons. Imports in 1979 were approximately 5.5 million gallons. In Canadian dollars, Canadian imports of the xylenes did not exceed $1.9 million in the years 1975-79.

Data on naphthalene imports to Canada are not available since naphthalene imports are part of a statistical "basket" category. These imports are believed to be negligible or nil.

Canadian BTX imports are determined largely by the health of Canada's economy. Here the word "economy" is signified by Canadian GNP, which may be loosely translated as "buying power". The other primary determinant of imports is price, according to the simplest economic theory of import demand. 2/ The

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1/ Canadian trade data does not permit a "straight" petroleum aromatic hydrocarbons calculation; data may include coal-derived chemicals as well as those derived from petroleum. There are other problems as well with these data, such as the inclusion of non-aromatic hydrocarbons in the export statistics.

2/ Relative prices (a ratio of import prices to domestic prices) are more appropriate than import prices as a determinant of imports. Unfortunately, trustworthy data on the world prices of primary aromatics are not available.

following tabulation presents a comparison of BTX imports and their theoretical determinants:

Year	Canadian BTX imports	Canadian GNP	Canadian BTX import unit values
	(million gallons)	(Can$ billion-1975)	(Can$/gallon)
1975	2.3	165	0.57
1976	8.5	1/ 174	.76
1977	7.5	1/ 178	.60
1978	8.2	1/ 184	.70
1979	15.3	1/ 189	1.06

1/ Partially estimated.

The statistics above indicate a general pattern of import growth which may be attributed partially to overall economic growth. At the same time that imports were increasing, however, import unit values were nearly doubling. While this last fact may appear perplexing at first, it is not so perplexing when one considers the movement of world oil prices during the same period, which prices doubled or tripled. Canada's increasing imports of BTX thus occurred during a period of economic growth, and imports were growing in a framework of decreasing prices relative to prices in many producing and consuming nations.

Exports

As mentioned earlier, Canadian export figures for the aromatic hydrocarbons are not published in usable form for individual chemicals by the Canadian Government. However, some of these figures are available from trade publications in quantity terms through 1978.

Canadian benzene exports grew without interruption from approximately 18 million gallons to 45 million gallons during the period 1975-78. The latter figure represents almost 20 percent of Canadian benzene capacity.

Toluene exports also grew without interruption during 1975-78. Exports of toluene were approximately 6 million gallons in 1975; by 1978, toluene exports had grown to over 51 million gallons, or 35 percent of Canadian industry capacity. There are no available mixed xylenes or naphthalene export figures for the late 1970's. P-xylene exports have been nil since 1975.

Canadian BTX exports are likely to grow further in the early 1980's, surpassing imports. 1/ First, BTX export growth and import diminution are goals of the Canadian industry. 2/ Secondly, Canadian BTX producers have been in a position of overcapacity, oversupply, and insufficient, though growing,

1/ European Chemical News, July 1978, p. 7.
2/ Chemicals Canada, Jan. 1978, pp. 8, 9.

domestic demand. 1/ The Canadian BTX industry will be actively seeking export markets as a result of these several occurrences and initiatives, and industry experts expect the Canadian BTX industry to succeed.

Consumption

Canadian benzene consumption, or apparent consumption adjusted for inventory changes, was just above 60 million gallons in 1975. During the late 1970's, consumption of benzene increased without interruption to more than an estimated 120 million gallons in 1979. While exports were growing without exception throughout the period 1975-78, and since imports were negligible or nil, nearly all the increase in benzene consumption was the consumption of domestic material.

Benzene consumption in Canada during 1978-79 hinged largely on the start-up of a world scale ethylbenzene plant in 1977. The average annual growth rate in consumption is expected to abate in the future, probably to between 2 and 3 percent annually.

Like benzene consumption figures, the following toluene consumption figures are apparent consumption adjusted for inventory changes. Since 1975, toluene consumed in Canada rose irregularly from about 24.5 million gallons to an estimated 29 million gallons in 1979. These figures exclude toluene hydrodealkylated to benzene.

Toluene consumption will likely increase about 5 percent per year until the mid-1980's, assuming no major change in prices, substitutes, and so forth. The phenol market should lead the way, in terms of growth, while solvent use is likely to grow at a rate less than phenol's expected 5 percent per annum.

If Canadian phenol production employs toluene feed to a greater degree than expected, consumption of toluene may well rise to about 55 million gallons per year by 1985. Otherwise, consumption will remain in the 30-38 million gallon range. 2/

Mixed xylenes consumption in Canada has been highly dependent upon the opening of one new xylenes processing facility in Ontario. While that facility was being built, there was little mixed xylenes consumption in Canada for the production of p-xylene, o-xylene, or for the production of isomer derivatives. A large percentage of Canadian mixed xylenes production was exported. In late 1978, the facility mentioned above was completed and mixed xylenes consumption was expected to increase, both for the Canadian gasoline pool and for use in making o-xylene and its derivative, phthalic anhydride, as well as for production of pesticide carrier.

P-xylene consumption in Canada will likely remain zero for 3-5 years. No data are available on Canadian naphthalene consumption, but consumption of naphthalene in Canada is believed to be small. The most notable aspect of

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1/ Various articles; The reader is referred to Chemicals Canada, Jan. 1978, pp. 8, 9.

2/ Industry sources.

present and of near-term future BTX consumption in Canada is the apparent dependency which benzene, toluene, and xylenes markets have upon what appear to be one or a very few construction projects or other occurrences. Canadian benzene consumption has purportedly been dependent on the completion of a single large ethylbenzene facility; toluene consumption depends heavily upon the degree of its employment in making phenol; and mixed xylenes consumption is dependent upon the opening and successful utilization of a single new processing unit for the making of isomers and their derivatives. Such a set of circumstances imply, to a degree, the acceptance of a high degree of risk.

Canada's current market situation of oversupply among the primary aromatic hydrocarbons, plus the "newness" of many ventures, would seem to dictate a policy or policies of distributing risks--in consumption as well as in trade, for example. One alternative for Canadian firms and U.S.-based Canadian firms would be to actively market BTX as export goods while the situation of low demand, or oversupply on the other side of the coin, has a chance to ameliorate. Actually, the plan of action articulated seems to be taking a different path.

Canadian benzene and toluene will likely be consumed in the production of derivatives and for other uses as follows (to 1985): 1/

Derivative	Benzene	
	1,000 metric tons	Percent
Ethylbenzene	265	70
Cyclohexane	80	20
Cumene	18	5
Maleic anhydride	4	1
Other	16	4
Total	383	100

Derivative	Toluene	
	1,000 metric tons	Percent
Solvent	50	60
Phenol	30	40
Total	80	100

Data on other aromatics are not available. Figures are approximate.

1/ Industry sources.

Future

Expansion Plans

Who, what, when, why, where

Substantial additions to Canadian BTX capacity were made in the late 1970's as part of an overall petrochemical expansion program. The overall expansion program, which was continuing in 1980, called for an investment of well over Can$2.0 billion. 1/ The ownership of BTX facilities will continue to be dominated by U.S.-based firms, while Canadian ownership will grow, but not as rapidly, and other countries, including Japan, will be investing in Canadian BTX facilities. Primary locations for these plants will be in Ontario, Alberta, and Quebec. Canadian BTX capacity is likely to increase from 1980 through 1984, 2/ most notably owing to three benzene plants scheduled for completion in the early 1980's.

Impact on industry

Since the middle 1970's several benzene expansions or expansion plans have dominated the Canadian BTX investment scene. Canada's leading aromatics producer, a U.S.-based firm, spent Can$50 million on its petrochemical operations in 1978; a good part of the investment was apparently spent on its benzene production facilities which may also impact the Canadian domestic market and Canadian export markets well into the 1980's. 3/

In 1978, another company made a significant expenditure on an aromatics extraction unit in Ontario--Can$22 million. This investment added significantly to Canadian benzene production capability in the late 70's and will influence to an important extent Canadian production and trade into the 80's as well. An announcement was made in late 1979 that a joint venture between a U.S. subsidiary and a Canadian firm will build a 100-plus million gallon benzene plant in Alberta in the early 1980's, at a cost of nearly $300 million. 4/ One world scale unit, to be completed in the mid-1980's, will add 150 million gallons per year to Canadian benzene capacity. 5/ Finally, two other benzene plants are in the offing, though plans are not yet firm.

Canadian toluene production expansion plans appear to fall well short of those for benzene. Aromatics experts predict capacity expansion to 1984 no greater than 16 million gallons per year. 6/ Canada's largest aromatics producer is scheduled to generate a substantial part of this toluene expansion. 6/

Mixed xylenes expansion for solvent use will be limited in the 1980's owing to environmental restraints. There is little use of mixed xylenes for making isomers at present. Xylenes use in gasoline will foster a greater

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1/ PROMT, a Predicasts publication, Apr. 1978, p. 152.
2/ Industry sources.
3/ PROMT, a Predicasts publication, Apr. 1978, p. 154.
4/ PROMT, a Predicasts publication, July 1978, p. 141.
5/ PROMT, a Predicasts publication, Oct. 1979, p. 100.
6/ Industry sources.

increase in expansion in the early 1980's as overall BTX capacity increases. Current capacity will not be expanded soon since there is little need for mixed xylenes as a primary aromatic feed to o-xylene makers. P-xylene will not be consumed in Canada before the late 1980's. 1/ Its use at that time is speculative, although p-xylene nearly always goes primarily to DMT and TPA. 2/

There are no known construction plans for naphthalene in the near term or long term. Accounts of the expansion of any existing facilities have not appeared in the trade journals, and are assumed to be negligible or nil.

The concentration of production ownership will be somewhat diluted with the fruition of Canadian expansion plans, e.g. the large benzene project which is a venture of Japanese concerns and Canadian companies. 3/ Capacity utilization is likely to remain low until domestic demand and the thirst for Canadian exports increase. Exports will go primarily to the United States and to Western Europe. Feedstock availabilities will likely be one of the least of Canada's concerns in the near term vis-a-vis expansion plans and probably will cause little or no appreciable difficulty during the 1980's.

Also, horizontal and vertical integration are going to increase as Canada's new FDI stance takes effect and as Canada's domestic demand increases. A large part of this greater integration achieved during the 80's will undoubtedly include more vertical and horizontal integration by firms already integrated in both respects. Both horizontal and vertical integration will work for Canadian BTX expansion owing to the carryover of expertise and experience, the knowledge of markets, and so forth.

Finally, in terms of expansion, Canadian aromatics producers will need to bring on new production facilities for cumene and cyclohexane to combat the overcapacity and/or oversupply of benzene. Cyclohexane and cumene markets are already developing in Canada. Further in terms of expansion, it would be advantageous for toluene producers in Canada to expand production of phenol from toluene, according to industry sources.

Demand

Forecast growth and reasons for growth

Canadian benzene demand is expected to grow with the coterminous growth of its availability. A low rate of growth in aromatics consumption was one of the industry's downfalls during the 1970's. Several companies, primarily in Ontario and Alberta, expect to capitalize on demand for derivative products in the "benzene tree", such as styrene, phenol, cyclohexane, and so forth, as greater production becomes available. 4/ Demand for Canadian benzene is expected to increase in the U.S. market. Price is one motivation for U.S. oil

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1/ Industry sources.

2/ DMT is the abbreviation for dimethyl terephthalate. TPA is the abbreviation for terephthalic acid.

3/ European Chemical News, Jan. 1978, p. 24 for example.

4/ "Prices are Up But Supply is Firm," Canadian Chemical Processing, June 6, 1979.

and chemical companies' importations; U.S. interests may be willing to pay marginally more than Canadian home market prices if U.S. producers are caught in a supply crunch at home. 1/

For a few years toluene demand has been running behind supply in Canada. Anti-pollution laws have partially accounted for a dying solvent market. Surpluses of the petrochemical have gone to the United States which has a BTX appetite that is increasingly difficult to satiate.

Demand for petrochemical derivatives of toluene is expected to increase by 5 percent per year, according to industry sources, and may amount to substantially over 30 million gallons by 1984. Demand for phenol may grow faster than the 5 percent per annum average toluene demand growth, while solvent uses of toluene will grow at a substantially lower rate--2 or 3 percent annually. 2/ Assuming phenol manufacture is from toluene and not cumene, by 1990 Canadian toluene demand could be from 45 to 60 million gallons per year. 2/

Canadian mixed xylenes demand in the future hinges upon export demand, primarily for the gasoline pool in the U.S. and for gasoline and other uses in Western Europe. There will be no demand for p-xylene and derivatives through the middle 1980's while mixed xylenes demand for making o-xylene and its derivatives may grow somewhat, but not substantially. 2/ Naphthalene demand figures for the 1980's are not available.

The Canadians are counting on increasing domestic demand for all primary aromatics and their derivatives in the 1980's. If these plans are not met, or if there are one or more major economic recessions, Canada may be forced to sell aromatics at somewhat unfavorable terms at home and on the world market. The result, if these recessions materialize, will be a temporarily flagging industry, most likely exhibiting profitability woes and little in the way of appreciable investment in Canadian aromatics for several years.

There will likely be no new uses developed for Canadian BTX during the early 1980's. However, as the decade wears on, p-xylene capacity may be developed and capacity for p-xylene derivatives will then follow. Other plans for such processing capabilities as mixed xylenes isomerization could lead to further "new" uses of primary and secondary aromatics in Canada.

Relationship to the U.S. and Mexico

Canadian benzene and toluene demand are expected to grow at approximately 2 percent and 5.5 percent per annum, respectively, through 1985; U.S. and Mexican annual growth rates for benzene will be 5 percent (U.S.) and 60 percent (Mexico) through 1985. U.S. demand growth for toluene through 1985 is forecasted at 3 percent per annum and Mexican toluene demand will likely grow at a 35 percent rate per year through 1985. 2/ Mexican benzene and toluene growth rates are not as difficult to explain as they may seem; PEMEX, and therefore the Mexican Government, have planned and set goals for capacity and

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1/ "Prices are Up But Supply is Firm," Canadian Chemical Processing, June 6, 1979.
2/ Industry sources.

production increases, and PEMEX has the wherewithal to "pull off" such large increases in capacity. 1/

As Mexican BTX capacity doubles or triples during the period 1980-1985, Mexico's population in the 80's is expected to increase at 3.5 percent per year, or by approximately 20 percent from 1980 to 1985, cutting into per capita consumption increases appreciably. 2/ At the same time Canadian and U.S. population growth rates will be about 1 percent per year or 5 percent overall to 1985. 3/ The Canadian BTX industry will grow at an average rate of 4 percent per year, outstripping population growth by 3 percent annually. U.S. BTX capacity will grow by at least 5 percent annually, outstripping population growth by 4 percent per year.

Thus per capita consumption will increase in all three countries, with Mexico losing a relatively larger part of BTX growth per capita owing to larger population growth. But Mexico, which is in a "take-off" stage of petrochemical production, should still experience far greater per capita consumption gains. These gains must be attributed to natural resources and to PEMEX's aggressive development. The U.S. and Canadian economies, which are both mature in nearly every respect compared to Mexico, are developing at a slower and steadier pace as market forces dictate consumption changes of a marginal nature.

Trade

Changes in imports and exports

Canadian BTX manufacturers were in a position of overcapacity throughout the late 1970's. This has resulted in, among other things, a greater use of BTX in the Canadian gasoline pool and greater export of BTX to the U.S. for the same use. In matter of fact, the general outlook for Canadian BTX demand will likely hinge not insubstantially on demand for Canadian aromatics abroad, especially in Western Europe and the United States. Heavy demand from either or both of those areas almost definitely would lead to trade surpluses in BTX and would contribute to an overall surplus in Canadian petrochemical trade. Duty-free access to the U.S. market for derivatives of the primary aromatics in exchange for Canadian natural gas and other hydrocarbon fuels is an important trade-off Canadians hope for in the 80's.

Industry sources have stated that, by the mid-1980's, Canada will be a "net exporter of petrochemicals to the U.S." Supporting this thesis, these industry experts point to the falling U.S. tariff rates on aromatics from 10 percent to half that value, a result of the Multilateral Trade Negotiations.

1/ This capacity and production growth is far from guaranteed, but the support of PEMEX is less dubious oftentimes than more volatile project supports in "free" economies.

2/ Industry sources and "World Population 1977," U.S. Department of Commerce.

3/ Canada's rate of growth will be possibly higher by as much as 0.5 percent and the growth rate of U.S. population could be lower by as much as 0.5 percent.

In addition to a growing U.S. market for Canadian petrochemicals, Canada's purchases of U.S. petrochemical exports will likely decrease. 1/

Mexico, Taiwan, and South Korea are expected to follow the Canadians in capturing a larger part of the U.S. BTX import market. Closer attention to the capacity and demand situations in Canada is therefore increasingly important to both Canadian nationals and to outsiders. It is believed that an integral and increasing part of Canadian-U.S. petrochemical trade development will be played by the export posture of Canadian BTX producers. 2/

Impacts on producers, consumers, and new uses 3/

As mentioned earlier, Canada may be able to raise its BTX export prices at times and still maintain price levels for the aromatics close to those of U.S. BTX producers, owing greatly to abundant feedstocks. This may be true of a number of export markets in Western Europe as well. Thus, Canadian primary aromatics export markets are likely to grow within the market economies assuming prices behave as expected. The degree to which Canada's exports of BTX grow will depend on supply-demand balances in market economies, especially in the U.S. and Western Europe. Prices and the development of markets in the third-world and in Communist-dominated areas are also likely to be strong determinants of future Canadian BTX producers' prosperity. These markets constitute new or growing export possibilities for Canadian producers of primary aromatics. Prime candidates for new markets are those countries formerly supplied by the U.S., Western Europe, and Japan, which latter countries may not be able to "sweeten" export deals sufficiently to overcome Canada's predicted offerings in terms of more attractive prices and assurances of supply.

Likely new trading partners and competitors

Canada's aromatics exporters will likely be competing in the future with the U.S., Western Europe, and Japan. They will further likely compete in some markets with OPEC nations and Mexico. Possible new or growing Canadian export customers outside the market economies include countries in South America, Asia, and Communist-dominated countries and areas.

1/ PROMT, a Predicasts publication, Oct. 1978, p. 121. Further, domestic (Canadian) consumption will increase by only 4-5 percent per year.

2/ PROMT, a Predicasts publication, March 1979, p. 135.

3/ Trade will likely be used as a tool to fight overcapacity and as an "engine for growth" by producers. Consumers will be firms capitalizing on "new" uses in Canada, i.e. new derivatives such as DMT/TPA, by the late 1980's.

MISCELLANEOUS ACYCLIC ORGANIC CHEMICALS

Present Situation

Description and Uses

Miscellaneous acyclic organic chemicals comprise many thousands of straight-chain organic compounds and mixtures which are nonbenzenoid in nature or derivation. Because of the vast array of compositions and end uses of these chemicals, it is more useful and meaningful to divide them into the following functional subgroups:

--Nitrogenous compounds
--Acids, acid anhydrides, and acyl halides
--Salts of organic acids
--Aldehydes
--Ketones
--Monohydric alcohols, unsubstituted, and halohydrins
--Polyhydric alcohols and their derivatives
--Esters of monohydric alcohols, organic acids, and inorganic acids
--Epoxides, halogenated epoxides, and ethers of monohydric alcohols
--Halogenated hydrocarbons
--Other miscellaneous acyclic organic chemicals

A brief discussion of each subgroup follows.

Nitrogenous compounds

This subgroup can be subdivided into amides, amines, ethanolamines, nitriles, and miscellaneous. The nitriles include the commercially important acrylonitrile, used in plastics resins and fibers and in nitrile rubber, and acetone cyanohydrin, used in insecticides and as a chemical intermediate. Ethanolamines are consumed in detergents, emulsifiers, and in further organic synthesis. The more important amines are butyl-, methyl-, ethyl-, and propylamines, all of which are consumed as intermediates for pharmaceuticals, pesticides, rubber processing chemicals, dyes, detergents, and other products.

Acids, acid anhydrides, and acyl halides

Acetic acid and its derivative, acetic anhydride, are the chief representatives of this subgroup; both are intermediates for any number of organic chemical end products. A third important commercial acid is adipic acid, which is a basic raw material for nylon fibers and resins.

Salts of organic acids

A-31

Organic salts result from combining metal or mineral ions with organic acids; a vast array of chemicals are produced in this fashion. The usefulness of any one salt may stem from either the metal ion component or the acid component, or both, depending upon the desired end product. Though this subgroup constitutes only a small portion of the miscellaneous acyclic organic chemicals group, the use of salts pervades nearly every facet of the chemical industry.

Aldehydes

Formaldehyde and acetaldehyde are the dominant items of this subgroup. The bulk of formaldehyde output worldwide is consumed in adhesives (especially for plywood) and plastics copolymers. Acetaldehyde and other aldehydes are used as solvents and as intermediates for drugs, flavor and perfume chemicals, photographic chemicals, and pesticides.

Ketones

There are three major ketones: acetone, methyl ethyl ketone (MEK), and methyl isobutyl ketone (MIBK). Acetone is used primarily to produce MIBK and other chemical intermediates. All three find solvent applications in paints, varnishes, lacquers, and other solvent uses. MEK is also used in the manufacture of smokeless powder; MIBK is often used for extraction of uranium from fission products.

Monohydric alcohols, unsubstituted, and halohydrins

Methanol, ethanol, isopropanol, and butanols all find applications in organic synthesis and solvent formulations; more specialized end uses vary by product. Ethylhexanol is an important plasticizer for polyvinyl chloride resins and has numerous other uses.

Polyhydric alcohols and their derivatives

Ethylene glycol and propylene glycol are the principal derivatives and end products of their respective precursors, ethylene oxide and propylene oxide. Ethylene glycol's chief end uses are antifreeze formulations and polyester fibers and films. Propylene glycol is consumed chiefly in the plastics industry.

Esters of monohydric alcohols, organic acids, and inorganic acids

This subgroup, like the salts, includes a large number of chemicals, but the most commercially important are the acetate and acrylate esters. These esters are used as solvents and as intermediates.

Epoxides, halogenated epoxides, and ethers of monohydric alcohols

The two most important epoxides, ethylene oxide and propylene oxide, are mainly consumed in production of their respective glycols. (See Polyhydric alcohols and their derivatives, above.)

Halogenated hydrocarbons

The largest item in this subgroup, ethylene dichloride, is mostly consumed in production of the next largest item, vinyl chloride monomer, a precursor for polyvinyl chloride (PVC) plastics products. Other chlorinated hydrocarbons (not otherwise halogenated) are used chiefly as solvents and intermediates. Fluorinated hydrocarbons are used chiefly as refrigerants (e.g., "freon"); their use as aerosol propellants has diminished in the wake of adverse publicity regarding their alleged destruction of the earth's ozone layer.

Other miscellaneous acyclic organic chemicals

It is impossible to characterize this subgroup, because the chemical makeup and end-use applications are too diverse. Important products and product groups include organo-sulfur compounds, silicones, phosgene, and lead alkyls.

Customs Treatment

Table D-5 lists duty rates for selected major chemicals in this sector. The base rates of duty represent the starting point from which Canada negotiated concessions in the Tokoyo Round of the Multilateral Trade Negotiations under the General Agreement on Tariffs and Trade. Prenegotiation rates in most instances were 15 percent ad valorem; exceptions were formaldelyde (10 percent), lead alkyls (10 percent), and certain organosilicon compounds (12.5 percent). The base rates are scheduled to be reduced in eight staged reductions, the final reduction to take effect January 1, 1987. The concession rates in table D-5 reflect the full negotiated reductions.

The final concession rates, with certain exceptions, fall into a relatively narrow range, 9.2 percent to 12.5 percent ad valorem. The exceptions include acrylonitrile (6.3 percent), for which Canada has no current or planned production capacity; sec-butyl alcohol for use in the manufacture of methyl ethyl ketone (free); and tetraethyl and tetramethyl lead anti-knock preparations (8.5 percent). There are no substantial non-tariff barriers against imports into Canada.

Structure of the Industry

In the miscellaneous acyclic organics sector, there are at least 12 producers with a combined capacity of at least 6.3 billion pounds per year. Of the 12 producers, ten are U.S.-owned--nine are 100 percent-owned subsidiaries; the tenth, a 56.6 percent-43.4 percent U.S.-Canadian joint venture. U.S.-controlled capacity accounts for more than 80 percent of the total sector capacity. The Canadian-owned firm accounts for about 15 percent, and the West German-owned firm, for the remainder.

Most of the sector is concentrated chiefly in three areas--Montreal, Quebec (16 percent); Sarnia, Ontario (22 percent); and Edmonton, Alberta (57 percent). These are the sites of concentration for ethylene, propylene, and natural gas feedstocks upon which the sector is based. Some of the major producers produce the feedstocks for their own use and for merchant sale, while others obtain their raw material needs through purchasing only. Though only a relatively small percentage of sector capacity is currently accounted for by British Columbia, the province will probably be the site for two new world-scale methanol plants being planned for construction before 1985.

Aggregate production data are not published, but based on estimated production of selected major chemicals, it is estimated that capacity utilization in the sector was about 65 percent in 1979. Substantial expansions in capacity for production of ethylene dichloride, vinyl chloride, and propylene oxide in 1979 combined to lower the utilization rate from the 1978 level of almost 90 percent.

Technology

The petrochemical facilities in Canada are economically efficient because of the fact that they tend to be built in large complexes which provide for product interrelationships, economy of scale, a shared infrastructure, and efficient pipeline networks for movement of feedstocks and products among plants.

The industry is highly capital intensive. In 1975, total gross investment in the Canadian petrochemical industry was estimated at $200,000 per employee, more than four times the average for all manufacturing in Canada. Historically, productivity has been about twice that of all manufacturing. It is estimated that 20 percent of all chemical employees in Canada are university graduates, and the need for technically trained employees continues to grow.

Process technology is the latest available, since ownership and control of the industry is mostly in the hands of some of the largest chemical corporations in the world. While about $2.1 billion was spent on capital investment in 1979, it is not believed that much, if any, of that was on research and development. Those functions generally are centered in the research programs of the U.S. and West German owner-corporations, and not so much in Canada.

Government Policies and Involvement

The Canadian Government has a substantial involvement in the public sector in general. Many of the natural resources, including oil, are managed by public, or "crown" corporations. For example the Government has 68 percent ownership in the Canada Development Corporation, which in turn owns (1) 100 percent of CDC Oil and Gas Ltd.; (2) 100 percent of Polysar Ltd.; and (3) 60 percent (directly and indirectly) of Petrosar Ltd. In addition, the Government has full or part ownership in at least seven other oil and chemical producing firms.

Production

Publishability of production statistics for downstream petrochemicals in Canada is severly hindered by the fact that in nearly all cases only one or two producers make an individual chemical. As in the United States, the confidentiality of producers' operations is protected by the requirement that there be at least three producers, no one or two of which are dominant in that production. In the case of miscellaneous acyclic organic chemicals, only one major chemical meets publishability criteria--formaldehyde. Nevertheless, industry sources have provided some estimates which will indicate the overall trend over the past 5 years.

Acrylonitrile

There is no Canadian production capacity, so imports have supplied consumption. Consumption of acrylonitrile has increased, however, indicating stepped-up activity downstream.

Formaldehyde

Production increased from 148.4 million pounds in 1976 to an estimated 198.0 million pounds in 1979. This represents an average growth rate of about 13 percent.

Acetone

Production increased from an estimated 60 million pounds in 1975 to about 70 million pounds in 1979. Since about 40 percent of Canadian output of acetone goes into producing methyl isobutyl ketone and other solvents, production of those chemicals is believed to have risen also.

Methanol

Production increased from an estimated 322 million pounds in 1975 to at least 1.2 billion pounds in 1979, or by more than 40 percent per year. It is estimated that more than 60 percent of that output was exported, mostly to the United States and Japan.

Isopropanol

Production increased from an estimated 68 million pounds in 1975 to about 90 million pounds in 1976, but declined by nearly half in 1978 because of A-35

plant operating problems. Production increased to about 85 million pounds in 1978, and continued upward in 1979 as capacity was expanded.

n-Butanol

Production during 1977-79 was static at an estimated 17.5 million pounds per year. Production was limited by available capacity, which was expanded by 25 percent in 1979.

2-Ethylhexanol

Production increased from an estimated 50 million pounds in 1975 to about 110 million pounds in 1979. It is estimated that a growing percentage of output is being exported (possibly as high as 70 percent in 1979), mostly to the United States.

Ethylene glycol

Production increased from an estimated 185 million pounds in 1975 to about 285 million pounds in 1979. During the period, imports from the United States and Europe were needed to meet domestic demand. However, a doubling of capacity in 1980 will call for increasing exports to keep utilization up through 1985.

Propylene glycol

Production estimates are not available, but based on production of propylene oxide, it is believed that PG production leveled off at less than 20 million pounds per year during 1977-79.

Vinyl acetate

There was no production capacity for vinyl acetate until late in 1979, when a 100-million-pound per year plant was brought on stream. Imports supplied consumption during 1975-79.

Ethylene oxide

Production increased from an estimated 225 million pounds in 1975 to about 300 million pounds in 1979. As new production capacity more than doubled capacity in 1980, future production increases will probably depend upon export opportunities.

Propylene oxide

Production increased from an estimated 85 million pounds in 1975 to about 115 million pounds in 1978, and leveled off there in 1979 because of capacity limitations. Since domestic consumption was less than production, exports made up the difference.

Ethylene dichloride

Production increased from an estimated 300 million pounds in 1975 to about 390 million pounds in 1979. The opening of a new plant in 1979 more than quintupled capacity.

Vinyl chloride monomer

Production increased from an estimated 170 million pounds in 1975 to about 200 million pounds in 1979. Production probably increased sharply in 1980 because of new available capacity.

Trade

Canadian trade data are published in such a manner that imports of miscellaneous acyclic organic chemicals can be only roughly estimated. Total Canadian imports are estimated to have increased from 562 million pounds ($184 million) in 1975 to 814 million pounds ($364 million) in 1979 (table A-6).

Imports of monohydric alcohols, polyhydric alcohols, epoxides, and "all other" chemicals, all trended downward during 1975-79, mainly because new capacity for production of key chemicals in those groups has come on stream in Canada. Though imports of halogenated hydrocarbons increased sharply during the period, it is believed that in future years imports will level off and probably decline for the same reason.

Export statistics for miscellaneous acyclic organics are combined with statistics for cyclic intermediates, and there is no reasonable basis for separating the two. However, based on other information, it is believed that during 1975-1979, Canada was a net importer of petrochemicals, but that the gap between imports and exports was narrowing. The United States was Canada's leading trading partner, but substantial trade is also carried on with Western Europe and Japan.

Consumption

Acrylonitrile

Consumption, supplied entirely by imports from the United States, increased from an estimated 38 million pounds in 1975 to about 53 million pounds in 1979. About half was consumed in the production of acrylic fibers; about one-third went into ABS resins; and the remainder, into nitrile rubber.

Formaldehyde

Consumption data are not available, but most is believed to have been consumed in production of adhesives.

Acetone

Consumption increased from an estimated 62 million pounds in 1975 to about 73 million pounds in 1979. About half was used in solvent applications; the bulk of the remainder was used to make other solvents (chiefly MIBK) and as an intermediate for bisphenol A, a precursor for epoxy and polycarbonate resins.

Methanol

Consumption data are not available, but methanol use is estimated to have grown significantly during 1975-79. Production increased at a much faster rate, and about 60 percent of output was exported, mostly to the United States and Japan.

Isopropanol

Consumption increased from an estimated 70 million pounds in 1975 to about 120 million pounds in 1975. About half was consumed in production of acetone; the other half, as solvent.

Ethylene glycol

Consumption climbed from an estimated 240 million pounds in 1975 to about 275 million pounds in 1979. The majority was consumed in antifreeze preparations; about one-fourth went into polyester fibers; and the remainder, in other applications.

Vinyl acetate monomer

Consumption was supplied entirely by imports during 1975-78, but some was produced domestically in 1979. Consumption rose from an estimated 25 million pounds in 1975 to about 45 million pounds in 1979. Polyvinyl acetate resins for coatings and adhesives account for most of the consumption.

Ethylene oxide

Consumption increased from an estimated 225 million pounds in 1975 to about 300 million pounds in 1979. About 75 percent of consumption was in production of ethylene glycol.

Propylene oxide

Consumption rose from an estimated 60 million pounds in 1975 to about 85 million pounds in 1979. The bulk of consumption was in polyols for polyurethane plastics.

Ethylene dichloride

Consumption increased from an estimated 300 million pounds in 1975 to about 400 million pounds in 1979. Vinyl chloride monomer accounted for the bulk of consumption.

Vinyl chloride monomer

Consumption rose from an estimated 170 million pounds in 1975 to about 350 million pounds in 1979. Most was consumed in polyvinyl chloride applications.

Future

Expansion Plans

Expansions have been announced for two major chemicals--methanol and ethylene glycol. The two existing producers of Canadian methanol have a combined capacity of 983 million pounds per year; both plan to expand such that their combined capacities will more than triple to 3.2 billion pounds before 1985. In addition, two more firms are each planning to build methanol plants in British Columbia. Their combined capacity would add another 1.75-billion-pounds-per-year capacity, bringing the Canadian total to 4.95 billion pounds per year, or 5 times current capacity, by 1985.

One producer has announced its intention to build a 496-million-pound-per-year ethylene glycol plant in Alberta, to be completed in 1984. Another producer is expanding its facilities in Saskatchewan, adding an additional 400-million-pounds-per-year capacity. A third petrochemical producer in Alberta is seeking to expand its EG production facility, but no definite plans have been announced to date.

Demand

Acrylonitrile

Demand for acrylonitrile in fibers is expected to remain static through 1985 because of capacity limitations on fiber. Nevertheless, average annual growth through 1985 will be 3.5 percent because of rising demand in ABS resins and nitrile rubber. Corresponding growth rates for Mexico and the United States are estimated to be 14 percent per year and 6.0 to 7.5 percent per year, respectively.

Acetic acid

Growth in demand is estimated to be 11 percent per year through 1985. In Mexico and the United States, growth rates are estimated at 13.5 percent per year and 5 to 7 percent per year, respectively.

Formaldehyde

Demand will grow about 4 percent per year, mostly in adhesives for wood products. Corresponding growth rates in Mexico and the United States are estimated to be 5 percent per year and 3.5 to 4.0 percent per year, respectively.

Acetone

Demand for acetone as a solvent and as a solvent intermediate is expected to grow 5 to 6 percent per year. Acetone's use to make bisphenol A is expected to remain static. Corresponding growth in acetone demand in Mexico will be 15 percent per year; in the United States, 4 to 5 percent per year.

Methanol

Home-market demand for methanol will grow about 5 percent per year, compared with 11 percent per year in Mexico and 10 percent per year in the United States. As demand rises in export markets, however, Canadian production will increase sharply.

Ethanol

There is limited production capacity for ethanol in Canada, and demand information is not available. Mexican demand data are also lacking, but the U.S. growth rate for synthetic ethanol is estimated to be 2.0 to 2.5 percent per year.

Ethylene glycol

Demand for EG in antifreeze is expected to grow at a moderate 2.5 percent per year, but in polyester fibers and other uses, it is expected to grow about 6 percent per year. Production levels will grow much faster because of export demand. Growth in EG demand in Mexico and the United States is expected to be 15 to 16 percent per year and 3.8 percent, respectively.

Ethylene oxide

Because of the projected growth in exports of ethylene glycol, EO demand is expected to grow 14 percent per year. Mexican growth will be 15 percent per year for similar reasons. U.S. demand growth is estimated to be 4.5 to 5.5 percent per year.

Ethylene dichloride

During 1980, demand for EDC will have jumped more than 40 percent because of new vinyl chloride capacity. Beyond that demand will grow about 10 percent per year through 1985. Corresponding growth rates in Mexico and the United States are expected to be about 40 percent per year and 5.0 to 6.5 percent per year, respectively.

Vinyl chloride

Because of rising domestic and export demand for VCM, growth is estimated at 13.5 percent per year through 1985. This will displace imports which recently had accounted for nearly half of consumption. Corresponding growth rates in Mexico and the United States are expected to be 13 percent per year and 6.5 percent per year, respectively.

Trade

Recent expansions and those planned through 1985 will result in capacity that can meet domestic demand for many years to come. To avoid under-utilization of that capacity, Canadian producers will have to exploit the export markets (especially the United States) more than they ever have in the past. Likely export items include methanol, ethylene glycol, vinyl acetate monomer, ethylene oxide, ethylene dichloride, and vinyl chloride. In those instances where exports are not likely, despite overcapacity, imports will be displaced as domestic demand increases.

Until the industry diversifies on a large scale, many secondary petro-chemicals will continue to be imported, chiefly from the United States, but also from Europe and Japan. Acrylonitrile is the prime example of a chemical for which there is no Canadian production capacity and for which there are no announced plans for development.

CYCLIC INTERMEDIATES

Present Situation

Description and Uses

Cyclic intermediates produced in Canada are petrochemicals used primarily to produce a variety of finished organic chemical products such as dyes, medicinal chemicals, pigments, pesticides, plastics, synthetic fibers, and synthetic rubbers. Some cyclic intermediates are also used to produce other intermediates which are used to manufacture the aforementioned finished organic products. For example, ethylbenzene is used to make styrene; cumene to make phenol. Styrene is polymerized to polystyrene while phenol is used in the production of phenolic resins and of bisphenol A, the precursor of epoxy resins and adhesives.

In 1978, the principal large volume cyclic intermediates produced in Canada were ethylbenzene, styrene, phthalic anhydride, cumene, cyclohexane, and phenol. The largest volume intermediate produced in Canada in 1978 was ethylbenzene. The two Canadian producers of ethylbenzene use most of their production to make styrene. Any remaining production of ethylbenzene is usually exported to the United States and other world markets.

Styrene monomer is derived from the catalytic dehydration of ethylbenzene. In Canada, over 80 percent of styrene production is used to produce polystyrene (including expandable polystyrene) and styrene-butadiene rubber (SBR). Increasing amounts of styrene have also been exported to the United States and Europe in the past few years. Polystyrene is used in packaging, appliances, housewares, furniture, and insulation for refrigerators. Styrene-butadiene rubber is used primarily for tires.

Other cyclic intermediate produced in Canada such as phthalic anhydride, cumene, phenol, toluene diisocyanate, cyclohexane, and aniline are used primarily in the production of plastics, resins, or synthetic fibers.

Customs Treatment

As a participant in the recent Multilateral Trade Negotiations (MTN) in Geneva, Canada was involved in negotiations with the United States, the European Community, and Japan to achieve the greatest possible liberalization of trade while maintaining limited access in certain clearly defined industrial sectors. As a result of these negotiations, Canada has made some reductions of import tariffs for certain chemicals including cyclic intermediates.

During the multilateral trade negotiations, Canada and the United States made a serious attempt to negotiate a bilateral agreement concerning petrochemicals and gas. Canada wanted freer access to U.S. markets through the elimination of import tariffs for a specific number of chemicals (including styrene) in return for a promise of increased gas exports from

Alberta to the United States. 1/ At that time, however, no agreement was reached since all tariff concessions were made on a multilateral basis.

Tariffs

Cyclic intermediates imported into Canada are assessed customs duties as specified in the Office Consolidation of the Customs Tariff published by the Department of National Revenue, Customs, and Excise. Duties assessed on cyclic intermediate chemicals are based on the "fair market" value which is taken to be the normal selling price in the country of origin of similar quantities of like goods sold to customers at or near the market level of the Canadian customer.

Canadian base rates of duty on cyclic intermediate chemicals are calculated on an ad valorem (ad val) percentage. Canada also has a most-favored nation rate of duty which, in most cases, is less than the base rate. In general, Canadian duty rates on intermediate chemicals are in line with the duty rates of other industrialized nations.

Some of the current rates of duty and the MTN concession rates for certain cyclic intermediates are found in table A-7.

Non-tariff barriers

As a participant in the multilateral trade negotiations in Geneva, Canada favored the inclusion of non-tariff issues on the Geneva agenda. Canada argued for the clarification and standarization of certain restrictive trade practices such as trade discrimination in government purchasing policies, an internationally accepted definition of what constitutes a subsidy, and temporary safeguards on selected products by a nation. 2/ At some time or another, these areas have caused problems for Canada in trade selections with other countries, especially the United States. As a member of the GATT, Canada has based its trade policies on that organization's principles to a much greater degree than Mexico. 3/

Structure of the Industry

Until recently, Government holdings in industry were not extensive. At the present time, private subsidiaries of multinational firms produce most of the cyclic intermediates in Canada.

In 1978, there were approximately 30 producers of cyclic intermediates in Canada. The four largest accounted for nearly 80 percent of production. This industry is concentrated in favor of the largest six to eight producers owing

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1/ Chemical and Engineering News, July 14, 1980, p. 14.

2/ "Canadian-U.S. Relations: Policy Environment, Issues, and Prospects", Canada-U.S. Prospects, Canada, 1979, pp. 77-78.

3/ The Dean Rusk Center, Comparative Facts on Canada, Mexico and the United States: A Foundation for Selective Integration and Trilateral Cooperation, Athens, Georgia, 1979, p. 79.

to the production of seven large volume intermediates at world-class facilities. For example, ethylbenzene, styrene, and phenol each had two producers while cumene, cyclohexane, and phthalic anhydride each had only one producer in 1978.

The cyclic intermediate industry in Canada is located mainly in three areas: Montreal; Sarnia, Ontario; and the province of Alberta. These are areas with large petrochemical facilities and raw materials. Alberta, particularly, has vast supplies of oil and gas; reserves have been estimated at about nine billion barrels of oil and 53 trillion cubic feet of gas, enough to provide Canada with adequate supplies of raw materials for the next decade at present production rates. 1/

In 1978, the operating rate for basic cyclic intermediates as a percentage of capacity was approximately 87 percent. Corresponding operating rates for some of the larger volume intermediates were as follows: 85 percent for ethylbenzene, 82 percent for styrene, 73 percent for phenol, 98 percent for cyclohexane, and 80 percent for phthalic anhydride.

Ownership

The large chemical companies producing cyclic intermediates in Canada are controlled primarily by companies in the United States. In 1980, the top ten chemical companies in sales for the first six months were all U.S.-controlled firms. 2/ Foreign control of all chemicals in Canada (principally U.S. firms) was about 85 percent in 1974. 3/

At the present time, the Canadian Government has little direct ownership in the cyclic intermediates industry. In 1978, only one major producer of cyclic intermediates was controlled by the Canadian Government through the Canadian Development Corporation.

Integration

Most producers of cyclic intermediates in Canada use part or all their production to manufacture more complex intermediates or finished products (i.e. plastics, resins, synthetic fibers, dyes, pigments, and so forth. For example, the two Canadian producers of ethylbenzene are also the only producers of styrene; most of their production of ethylbenzene is captively consumed to manufacture styrene.

The major cyclic intermediate producers in Canada are not horizontally integrated to a great extent. In 1978, most intermediate producers manufactured less than six different cyclic intermediates. One of the largest producers reported making only 12 intermediates in 1978. 4/

1/ The Dean Rusk Center, op. cit., p. 121.

2/ Chemical and Engineering News, August 11, 1980, p. 8.

3/ B. Wilkinson, "Canada in the Changing World Economy," Canada-U.S. Prospects, Canada, April, 1980, p. 73.

4/ Canadian Chemical Register, Department of Industry, Trade, and Commerce, Ottawa, Canada, 1978, p. 220.

Very few producers of cyclic intermediates in Canada are vertically integrated to the extent that they produce one or more of the basic raw materials (i.e., benzene, toluene, and the xylenes) used in the manufacture of cyclic intermediates. At the present time, only three private firms which produce one or more of the basic raw materials also make cyclic intermediates.

Foreign investment

The United States, by far, is the largest foreign investor in the Canadian petrochemical industry. U.S. subsidiaries which produce chemicals, including cyclic intermediates, are among the largest chemical producers in Canada. As the largest producers, they have considerable influence on the future growth of this industry in Canada.

Technology

For information concerning technology, see the Technology in the olefins section of this report.

Government Policies and Involvement

Through the Canadian Development Corporation (68 percent controlled by the Government), the Canadian Government has been increasing its ownership of chemical firms. At the present time, it is involved in only one firm which produces any significant amount of cyclic intermediates.

Specific statistics regarding the cost of environmental regulations for the cyclic intermediate or petrochemical industry are not available. Estimates for the annual cost of environmental regulations on the private industry in Canada are around $6 billion.

Production

Annual statistics for the production of all cyclic intermediates manufactured in Canada are not available. However, production for the six largest volume cyclic intermediates increased from 425,000 metric tons in 1975 to 795,000 metric tons. This 87 percent increase from 1975-78 was owing primarily to world-capacity plants of certain intermediates coming on stream.

Production of styrene, a large-volume intermediate, increased by 40 percent in 1978 owing to a large increase in the export market. These exports went primarily to the United States and Europe. During 1975-1978, production of styrene increased at an annual growth rate of 28 percent. Also, during that period, production of ethylbenzene, the precursor for styrene, increased from 151,000 metric tons in 1975 to 343,000 metric tons in 1978 at an annual growth rate of 42 percent. Exports of ethylbenzene amounted to less than 5 percent of production in 1978.

Production of other major cyclic intermediates did not increase as quickly as styrene and ethylbenzene. For two intermediates, cumene and phenol, production did not essentially change during the period 1975-78. Cyclohexane production increased slightly from 65,000 metric tons to 87,000 metric tons in 1978.

Data for the total production value of cyclic intermediates are not readily available. However, total shipments of chemicals and chemical products in 1979 amounted to approximately C$9.4 billion, an increase of 18 percent over 1978. Shipments of industrial organic chemicals which include cyclic intermediates increased by 43 percent from the 1978 level. 1/

Trade

In 1979, Canada registered its first small positive balance of trade for chemicals. 2/ Rising world oil and gas prices made Canadian petrochemicals more competitive in the world market because of low-cost domestic feedstocks. Separate statistics for cyclic intermediates are not available but industry sources believe Canada is still a net importer of these products, mainly from the United States.

In 1978, Canada exported an estimated $2.1 billion of chemicals while importing an estimated $2.5 billion. The United States accounted for 68 percent of imports and received 85 percent of Canadian chemical exports. 3/ This negative balance of trade was also reflected in the statistics for some major cyclic intermediates, although styrene and ethylbenzene did show a small favorable balance of trade. Phenol, cyclohexane, and toluene diisocyanate all had a negative balance of trade in 1978. Many other intermediates are imported into Canada because there is no domestic production at this time to satisfy demand.

Imports

In 1978, imports of all chemicals and chemical products into Canada were valued at $2.5 billion. Imports from the United States, Canada's largest supplier, accounted for 68 percent of these imports. Other major exporters of chemicals to Canada include the United Kingdom, West Germany, Japan, the Netherlands, and France.

Statistics for individual cyclic intermediates are not readily available. In many cases, intermediates and other chemicals are grouped together in a tariff item number by functional groups (e.g. hydrocarbons, n.e.s.). Intermediates with individual items numbers show the dominance of United States imports. For example, in 1978, total imports of phenol were 11.3 million pounds essentially all from the United States. Imports of terephthalic acid totalled 79.7 million pounds, all but 15 thousand pounds of which was imported from the United States. Terephthalic acid was also the largest volume cyclic intermediate imported into Canada in 1978.

1/ *Chemical and Engineering News*, December 24, 1979, p. 41.
2/ *Chemical and Engineering News*, Dec. 24, 1979, p. 40.
3/ *Chemical and Engineering News*, July 14, 1980, p. 18.

Exports

Statistics for individual cyclic intermediates exports from Canada are not available. In 1978, domestic production of intermediates was hardly sufficient to supply domestic demand and as a result only small amounts of certain intermediates were exported. For example, exports of phthalic anhydride, which were approximately 4,000 metric tons in 1978 went to the United States (34 percent) and Western Europe (66 percent). Besides the United States and Western Europe, exports of intermediates from Canada went to such countries as Japan, Brazil, Australia, Mexico, Israel, Argentina, Venezuela, and the Peoples Republic of China.

Consumption

During the period 1975-78, apparent consumption for nine major cyclic intermediates increased from 506,000 to 790,000 metric tons for an annual growth rate of 19 percent. In 1978, imports of these intermediates accounted for 79,000 metric tons of the apparent consumption compared to 67,000 metric tons in 1975. This increase was owing primarily to increased demand for intermediates not produced in Canada.

Some intermediates, however, showed a decline in imports as apparent consumption rose because of increased production capacity for these products over the past few years. For example, imports of phthalic anhydride decreased from 9,000 metric tons in 1975 to 1,000 metric tons in 1978 while apparent consumption increased from 23,000 metric tons in 1975 to 28,000 metric tons in 1978. The increased consumption was supplied by domestic production capacity which increased from 25,000 metric tons units to 39,000 metric tons in 1978. Several other intermediates, notably styrene and ethylbenzene, have experienced similar import declines despite increasing consumption, since domestic capacity grew to exceed consumption.

Future

Expansion Plans

As part of its program to become a more competitive petrochemical producer in the world market, Canada is continuing to build world-scale facilities for petrochemicals. Although most of the plants now being built are to produce basic petrochemicals and major commodity resins, plants to produce intermediate chemicals which utilize these basic petrochemicals will be built in the 1980's.

Who, what, why, when

The name-plate capacity for styrene, which has been increasing over the past few years, will continue to increase through 1984 with the announcements of plans to build two new plants. One producer of styrene at Sarnia, Ontario, recently replaced an old 250 million pound-per-year unit with a near 600 million pound-per-year capacity unit. 1/ A U.S. firm and a Canadian firm recently announced plants to build a 660 million pound-per-year styrene plant at Scotford, Alberta, which is scheduled to come on-stream in 1984. Another U.S. subsidiary firm and Canadian company have also announced plans to build a 900 million pound-per-year styrene plant near Bruderheim, Alberta, scheduled for completion in the early 1980's. 2/ This plant will also produce ethylbenzene to be used in a continuous process to make styrene. This large increase in styrene capacity will probably be exported mainly to the United States, Japan, and Western Europe as the demand in the domestic market (e.g. polystyrene) will be much less than the projected styrene capacity.

Data for other cyclic intermediate projects are not readily available. The increased capacity of basic petrochemicals at the two large petrochemical facilities in Sarnia, Ontario, and Alberta have aroused the interest of several foreign firms to build chemical plants (including cyclic intermediates) in Canada.

Demand

Future demand for cyclic intermediates produced in Canada will depend on Canada's ability to compete in the export market and also on the future demand by domestic producers of finished products (e.g. plastics, synthetic fibers, and synthetic rubbers) which in turn may be exported. The projected annual growth rate for polystyrene, the major use of styrene, during the period 1978-85 is 6 percent.

Reasons for growth

One of the major factors in the projected increase growth rate of cyclic intermediates is Canada's increasing gross national product (GNP). In 1978, Canada's GNP was C$230 billion (in current dollars) and was projected to increase to C$276 billion (1977 dollars) by 1985. This increase was to be based in part on a substantial increase in chemical exports which include intermediate chemicals and plastics. Another factor which will influence domestic demand for intermediate chemicals is Canada's increasing population. The population is expected to increase from 23 million in 1976 to 26.7 million in 1990. This increasing population is expected to increase the consumption of plastic products manufactured initially from certain cyclic intermediates.

Relationship to the United States

The United States as the largest petrochemical producer and neighboring country will become more important to Canada as an export market for its increasing cyclic intermediates capacity in the coming years.

The annual growth rate of styrene produced in Canada is expected to average 5 percent through 1984, slightly less than the 7 percent predicted for the United States. Other cyclic intermediates produced in Canada such as

1/ Chemical and Engineering News, Feb. 25, 1980, p. 15.
2/ Chemical and Engineering News, Nov. 10, 1980, p. 9.

phenol, cumene, phthalic anhydride, and cyclohexane are predicted to have similar growth rates to the U.S.-produced intermediates.

Relationship to Mexico

Although Canada and Mexico are not significant trading partners, both include the United States as a major trading partner. Canada and Mexico are similar in that both have huge oil and gas reserves. Canada has a much better infrastructure than Mexico and also a lower percentage of unemployment for its population (8.4 percent in 1978 vs. 49 percent for Mexico). Mexico's larger population of 66.5 million in 1978 however, is better able to sustain world class petrochemical facilities than Canada which must rely more on increasing export markets.

Trade

Canada's increasing capacities in intermediate chemicals, particularly ethylbenzene and styrene, will result in larger exports by the mid-1980's. The expected export markets for these products are probably the United States, Japan and Western Europe. Canada may also export increasing amounts of intermediates to South America, particularly Brazil, Venezuela, and Argentina, and to Korea and Taiwan.

Changes in imports and exports

As Canada's new plants become operational, imports are expected to decline. Despite Canada's increasing population, most of the capacity from these new plants will be exported as the population will not initially be able to sustain these new capacities. These new plants are needed if Canada wants to be economically competitive with the United States, Japan, and Western Europe. The United States, as Canada's major source of cyclic intermediates, is expected to lose a great deal of this market in the coming years. Some specialty chemicals including certain intermediates will continue to be imported by Canada since the domestic market in Canada is not ever expected to be large enough to support these chemical plants.

Likely new trading partners

As Canada begins to export large volumes of cyclic intermediates, particularly ethylbenzene and styrene, it will probably look also to the developing countries of the world as markets for its excess production of these chemicals. By 1985, countries in Central and South America, the Middle East, the Caribbean, and the Far East are expected to be areas for Canadian petrochemical exports.

Impact on producers, consumers, and new applications

Because of the availability of low cost feedstocks, Canada can produce intermediates at a lower cost than most other world producers. The cost differential should benefit the domestic producers of items manufactured from these intermediates (e.g. plastics, synthetic fibers, synthetic rubbers, and so forth) and the Canadian consumer of the finished products. Lower cost intermediates and the resulting finished products which are exported will be economically competitive in the world market and help Canada maintain a positive balance of trade in chemicals.

Canada will probably not use its cyclic intermediates for major new uses in the near future. The large volume cyclic intermediates are used primarily to produce plastics, synthetic fibers, and so forth. These products, however, are used to make a variety of products such as textiles, automobile parts, household appliances, packaging materials, and television sets. Many of these products are ultimately exported throughout the world which benefits the Canadian economy.

PESTICIDES

Present Situation

Description and Uses

Pesticides is a generic term which covers a wide range of chemicals used to restrict or destroy pests. The three major categories of pesticides are fungicides, herbicides, and insecticides.

Fungicides are primarily used on farm crops, although not as frequently and in smaller amounts compared to the use of insecticides and herbicides. Some fungicides are successful as preharvest defoliants on selected crops, and are also used as wood preservatives. An example of this type of fungicide is pentachlorophenol (PCP).

Herbicides are used to kill plants or to interrupt their normal growth. Among these herbicides is 2,4 dichlorophenoxyacetic acid (2,4-D). Cotton, corn, and peanuts are some of the crops that benefit from the use of this chemical.

Insecticides are chemicals used to prevent, destroy, repel, or mitigate insects. Some insecticides are used to control insects that feed on tabacco seeds and peach trees. Paradichlorobenzene (PDB) is one of these insecticides.

Pesticides are marketed either as technical grade chemicals or as formulated materials. The technical grade chemical pesticides are the active ingredients which restrict or destroy pests. These chemicals are the pesticide intermediates used by formulating companies to produce the formulated materials or formulated pesticides. The formulated materials combine active ingredients with materials such as diluents, extenders, emulsifiers, synergists, and wetting agents to increase the effectiveness of the pesticide.

Customs Treatment

The Canadian tariff structure consists of British preferential, most favored nation (M.F.N.), general, and general preferential rates of duty. Of these four classifications, the United States and Mexico are entitled to M.F.N. tariff treatment.

Tariff

Before June 1, 1980, pesticides were classified under Canadian tariff item 93811-1 and were duty free except "when in packages not exceeding 3 pounds each gross weight", in which case they were classified under item 93811-2 with a most favored nation duty rate of 7.5 percent ad valorem (table A-8). All pesticides were included in items 93811-1 and 93811-2, with the exception of 2,4-D and its derivatives "when in packages exceeding 3 pounds each gross weight", which were classified under item 93811-3, with a duty rate of 15 percent ad valorem (ad val.).

As a result of Tokyo round agreements, the duty rate for pesticides under item 93811-3 has been reduced to an M.F.N. duty rate of 14.8 percent ad val., effective 1980, with further reductions to occur in 1981 to an M.F.N. rate of 14.6 percent ad val. The duty rates of items 93811-1 and 93811-2 will remain unchanged.

Non-tariff barrier

Under the Pest Control Products Act of Canada, all pesticides manufactured or imported for consumption are required to be registered by brand. As of June 1979, pesticides banned or restricted from use in Canada include aldrin, DDT, dieldrin, heptachlor, and leptophos. Canada's registration procedure, in addition to patent rights, constitute the major non-tariff barriers which inhibit imports.

Structure of the Industry

In 1977, the Canadian pesticide industry was composed of about 107 firms, mostly formulators, having sales of $10,000 or more. Of these firms, about 13 were believed to be manufacturers of active ingredients, operating about 36 plants. These plants were mostly located in the Provinces of Alberta, Quebec, Ontario, and British Columbia. 1/

Also in 1977, there was one manufacturer of PCP operating one plant, two manufacturers of 2,4-D operating 6 plants, and one manufacturer of PDB operating 3 plants. Four companies, operating 10 plants held 81 percent of the total pesticide production.

Ownership

The Canadian pesticide industry is mostly foreign-owned. Over 69 percent of the producers in the industry are affiliated with foreign (primarily U.S.-based) multinational parent companies. The remaining 30 percent are privately owned Canadian firms.

All the PCP and 2,4-D produced in Canada in 1977 was manufactured by U.S. owned companies. 2/ All the PDB was produced by a single Canadian owned firm. 3/

Integration

Many producers in the Canadian pesticide industry are to some extent both vertically and horizontally integrated. The larger vertically integrated

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1/ U.S. Department of Agriculture, The Pesticide Review, 1977, p. 19; and Statistics Canada, Miscellaneous Chemical Industries, 1975-1977, Canada, July, 1979, p. 3-5.
2/ Department of Industry, Trade, and Commerce, Canadian Chemical Register, 1978, Canada 1979, pp. 46 and 102.
3 Ibid., p. 45.

companies are well equipped with the technology needed to carry out the production of pesticides from internally produced feedstock sources. These companies offer a wide range of products on the market, including resins, pharmaceuticals, and explosives, constituting horizontal integration.

The following tabulation depicts the petrochemical origin and development of three pesticide products:

Starting material	Intermediate	Pesticide product
Benzene	Chlorobenzene p-nitrochlorobenzene	PDB
	sodium-p-nitrophenoxide	
Cumene	Phenol	PCP
	2,4-D-dichlorophenol	2,4-D

The producers of these selected products can be supplied with adequate quantities of feedstocks from many sources including the Alberta or Pestrosar petrochemical projects.

Foreign investment

For general information about foreign investment, see Foreign investment in the Olefins section of this report.

Technology

Canadian pesticide technology originates from chemical processes that are well known throughout the world pesticide industry. These processes include distillation and halogenation reactions which were previously used to develop pharmaceutical chemicals. 1/

Canadian pesticides are usually produced in large jacketed kettles in which pressure and temperature may be carefully monitored, and from which a large volume of product may be recovered. An additional convenience of the jacketed kettle is that it retains toxic fumes produced in the chemical reaction.

Most of the technology in Canada has been imported, primarily from the United States. Consequently, there is a close relationship in the pesticide technology of these two countries.

1/ Distillation reactions involve the separation of two chemical entities through boiling; halogenation reactions involve the addition of chlorine, bromine, iodine, fluorine or astatine to an organic compound.

Government Policies and Involvement

Production facilities

Canada's Federal Government does not participate in the production of pesticides. However, it does set policies which affect the industry.

Government-industry relationship

The Canadian Government, through various agencies, controls to a small degree the affairs of its pesticide industry; the Canadian Government restricts environmental pollution, requires licenses before permitting international trade, and so forth. Canada's Federal Government will impose a high penalty on those pesticide producers that violate Canadian pollution standards. This deterrent, however, is only minimally enforced because the Canadian Government allows pesticide producers to voluntarily control pollution through Government-accepted methods of waste disposal.

Production

Separate data on the production of technical grade chemical pesticides were not available. However, estimates on production during the period 1975-77 indicated a decreasing trend in production, from about 32 million pounds in 1975 to approximately 22 million pounds in 1977. 1/

Production of fungicides decreased from about 10 million pounds in 1975 to an estimated 3 million pounds in 1977. However, PCP production increased from 171,000 pounds in 1975 to 291,000 pounds in 1976. 2/

Herbicides production also decreased during the period 1975-77, according to estimates, by as much as 40 percent from 21 million pounds to 12 million pounds. During the same period, 2,4-D production decreased by 21 percent from 12 million pounds to less than 10 million pounds. 3/

Insecticides production also decreased, according to estimates, by 32 percent from 3 million pounds in 1975 to about 2 million pounds in 1977. During the same period, PDB production decreased by 24 percent from less than 3 million pounds to 2 million pounds. 4/

Most of the decline in production during the period 1975-77 was owing to what is believed to be an overcapacity situation and a lack of available markets. In addition, this apparent trend in production was also owing to a small supply of intermediates.

1/ Estimated from Statistics Canada, Miscellaneous Chemical Industries, 1975-1977, Canada, July 1979, pp. 3-5.
2/ Ibid.
3/ Ibid.
4/ Ibid.

Trade

Separate data on Canadian trade of technical grade chemical pesticides were not available. However, data on trade in pesticide formulations indicated that Canada was accumulating an increasing trade deficit during the period 1975-79.

Imports

During the period 1975-79, pesticide imports in Canada increased from about 86 million pounds 1/ in 1975 to more than 103 million pounds 2/ in 1977, decreasing to about 74 million pounds in 1979. 3/ During the same period, the value of pesticide imports increased from less than C$67 million in 1975 4/ to about C$90 million in 1979. 5/

In 1979, the United States was the major source of Canadian pesticide imports accounting for 98 percent of the total. 6/

Fungicide imports increased, from about 3 million pounds 7/ in 1975 to approximately 4 million pounds in 1979. 8/ The value of fungicide imports also increased, from about C$3 million 9/ in 1975 to about C$6 million in 1979. 10/

Herbicide imports increased from about 66 million pounds 11/ in 1975 to almost 73 million pounds in 1979. 12/ The value of herbicide imports increased from about C$56 million 13/ in 1975 to about C$94 million in 1979. 14/

Insecticide imports decreased from about 27 million pounds 15/ in 1975 to less than 6 million pounds in 1979. 16/ The value of insecticide imports decreased from about C$19 million 17/ in 1975 to less than C$7 million in 1979. 18/

1/ Statistics Canada, Imports, Merchandise Trade, 1977, Canada, 1978, pp. 308 and 310.
2/ Ibid.
3/ Statistics Canada, Imports, Merchandise Trade, 1979, Canada, 1980, pp. 324 and 326.
4/ Imports, 1975-77, op. cit., pp. 308 and 310.
5/ Imports, 1977-79, op. cit., pp. 324 and 326.
6/ Ibid.
7/ Imports, 1975-77, op. cit., pp. 308 and 310.
8/ Imports, 1977-79, op. cit., pp. 324 and 326.
9/ Imports, 1975-77, op. cit., pp. 308 and 310.
10/ Imports, 1977-79, op. cit., pp. 324 and 326.
11/ Imports, 1975-77, op. cit., pp. 308 and 310.
12/ Imports, 1977-79, op. cit., pp. 324 and 326.
13/ Imports, 1975-77, op. cit., pp. 308 and 310.
14/ Imports, 1977-79, op. cit., pp. 324 and 326.
15/ Imports, 1975-77, op. cit., pp. 308 and 310.
16/ Imports, 1977-79, op. cit., pp. 324 and 326.
17/ Imports, 1975-77, op. cit., pp. 308 and 310.
18/ Imports, 1977-79, op. cit., pp. 324 and 326.

Exports

Canadian exports of pesticide formulations decreased from 11 million pounds 1/ in 1975 to more than 5 million pounds 2/ in 1978; these exports then increased to more than 8 million pounds in 1979. 2/ During the same period, the value of exports of Canadian pesticide formulations decreased from about C$17 million 3/ in 1975 to approximately C$8 million 4/ in 1978, and increased to about C$12 million 4/ in 1979. Data for exports of Canadian fungicide, herbicide, and insecticide formulations are not available, but are believed to be contained in the total pesticide export figures.

The main markets for Canadian pesticide formulations, during the period 1975-79, were the United States and Cuba. In 1979 these two countries imported more than C$8 million 5/ of Canadian pesticide exports, representing more than 67 percent of total Canadian pesticide exports in that year.

Consumption

Separate data for consumption of technical grade chemical pesticides are not available. However, Canadian sales of pesticide formulations totalled $191 million in 1977, increasing by 5 percent in 1978 to $182 million. Sales of pesticides for agricultural use totalled about $160 million in 1977. 6/

Insecticide consumption increased to an estimated 16 million pounds in 1977 from 14 million pounds in 1976 or by 15 percent. Data for consumption of fungicides and herbicides are not available. 7/

Future

Expansion Plans

The Canadian pesticide industry will strive for continued growth by obtaining new markets abroad, and by expanding the existing U.S. market. Due to existing high levels of capacity, the industry will most likely invest capital in new equipment in order to supply other areas in Canada.

1/ Statistics Canada, Exports, Merchandise Trade, 1974-76, Canada, 1977, pp. 229 and 230.
2/ Statistics Canada, Exports, Merchandise Trade, 1977-79, Canada, 1980, pp. 234 and 235.
3/ Exports, 1974-76 op. cit., pp. 229-230.
4/ Exports, 1977-79, op. cit., pp. 234 and 235.
5/ Ibid.
6/ U.S. Department of Agriculture, The Pesticide Review, 1977, 1978, p. 19.
7/ Calculated from Statistics Canada, Miscellaneous Chemical Industries, 1975-1977, Canada, July, 1978, pp. 3-5.

Who, what, when, why, where

Data on individual pesticide companies or plant projections are not available. Government incentives, such as the Federal Regional Development Incentive grants, will provide a means through which the Government will share the costs of plant expansions, not exceeding $30,000. Furthermore, these incentives, like those in Mexico, will help promote economic growth in areas with little industrialization.

Impact on industry

Any increase in pesticide production capacity must be justified by current and/or expected increases in demand; otherwise inventory surpluses or declining sales will drive prices down. Approximately 85 percent of total Canadian pesticides produced are used in agriculture. Therefore, the Canadian pesticide industry's increases in capacity are linked with the growth of the agricultural industry.

Demand

Demand for world pesticides was expected to increase at an average growth rate of 4.7 percent per year. With a rapid growth rate in pesticide use in Brazil, Canada should have no difficulty increasing its export potential. The United States pesticide market is increasing at a rate above the world average growth rate. Both the U.S. and Brazilian markets are readily accessible and reliable markets for Canada. 1/

Forecast growth

Worldwide use of pesticides is expected to grow at an average rate of 4.7 percent per year. Forecasts for the use of pesticides worldwide during the period 1978-84 reveal the following growth rates for the major classes of pesticides: (1) herbicide demand is expected to increase by 29 percent; (2) insecticide demand is expected to increase by 11 percent; and (3) fungicide demand is expected to increase by 28 percent. 1/ Canada's demand for pesticides is expected to be below the world average growth rate of 4.7 percent per year.

Reasons for growth

Crop protection worldwide is dependent on chemical pesticides, until such time as biological pesticides such as sex attractants, and other forms of milder pest control, studied under the Integrated Pest Management Program (IPM) can be put into effect, there will be an increased demand for chemical pesticides. Farmers, at present, are abandoning mechanical means of cultivation due to rising fuel costs in Canada and adopting the use of chemical pesticides. Increased land utilization by Canadian farmers is expected to affect growth in demand for pesticides.

1/ U.S. Department of Agriculture, Evaluation of Pesticide Supplies and Demand for 1980, March 1980, p. 14.

Trade

Increased growth rates in the pesticide markets of certain countries (e.g., Brazil) will likely cause an increase in Canadian export trade. Such an increase in trade should provide the opportunity necessary to increase Canadian pesticide industry capacity and to ease Canada's pesticide trade deficit. Furthermore, increased trade could provide the necessary capital for research and development. However, with the rising cost of raw materials, an increase in trade is not likely to benefit the pesticide consumer to any significant degree.

Relationship to the United States

Canada and the United States have mutual access to each other's markets. In addition, the relatively lenient policies on foreign ownership espoused by both countries has led to more than 50 percent U.S. ownership of the Canadian pesticide manufacturing industry, and consequently to a close resemblance in the pesticide technology of these two countries.

Relationship to Mexico

Canada and Mexico trade in chemicals as well as exchange technology, but these countries' trade in pesticides is limited. Mexico, with its policy of self-sufficiency, is promoting new growth in its petrochemical industries in order to curtail imports. But Mexico's lack of infrastructure, which is necessary to support large scale production and distribution, is slowing down its growth. In contrast, Canada's pesticide industry is not unlike that of the United States in terms of technology and infrastructure.

Like Mexico, Canada's pesticide industry is small in comparison to that of the United States, and thus it produces a limited number of products which do not offer much variety of choice for world markets. In addition, Canada must import to satisfy its internal demand, as does Mexico. Both countries have little or no tariff restrictions on pesticides.

Changes in imports and exports

The future trends in Canadian pesticide trade point toward increasing both imports and exports. However, with the new petrochemical projects, Petrosar and Alberta, providing intermediates, Canada will likely decrease imports of pesticide intermediates, while simultaneously increasing exports.

Likely new trading partners

China, the U.S.S.R., and Brazil have the highest demand growth rate for pesticides. Cuba has been a trading partner of Canada on occasion. Canada may intend to provide a larger share of the Cuban market which is expected to grow.

Impact on consumers, producers, and new uses

Canada will benefit by diversifing its pesticides' export market worldwide. An increase in export demand will promote the increases in capacity which are vital to an active, dynamic industry.

Agricultural consumers in Canada should benefit from the variety of products that should come with an expected increase in production capacity. Finally, a growing industry, will increase Canadian industry development through R. & D. efforts. This will likely further lead to an even greater improvement in the Canadian pesticide industry's trade balance.

ANHYDROUS AMMONIA AND NITROGENOUS FERTILIZERS

Present Situation

Description and Uses

The description and uses of anhydrous ammonia and nitrogenous fertilizers in Canada are the same as those in the United States.

Customs Treatment

Canada uses a variation of the Brussels Tariff Nomenclature for the structure of its tariff system. Anhydrous ammonia is, therefore, listed as an inorganic chemical in what is equivalent to chapter 28 of the Brussels system, while the ammonia derivatives that are principally used as fertilizers--ammonium nitrate, urea, ammonium sulfate, and so forth--are listed as fertilizers in the equivalent to chapter 31.

Tariff

All nitrogenous fertilizers enter Canada duty free. The duty on anhydrous ammonia was reduced from 10 percent ad valorem to free as a concession in the most recent round of trade negotiations. Canadian tariff rates for fertilizers are recorded in table A-11, by tariff item number.

Non-tariff barrier

There are few, if any, non-tariff barriers to shipment of nitrogenous fertilizers into Canada.

Structure of the Industry

The Canadian fertilizer industry is mostly comprised of large integrated chemical, petroleum, and fertilizer companies and farmer co-operatives.

There is a substantial investment in ammonia and nitrogenous fertilizer plants by U.S. companies. Other foreign investors include the United Kingdom and Belgium.

Technology

The technology used to produce ammonia and other nitrogenous fertilizers in Canada is the same as is used to produce those chemicals in the United States.

Government Policies and Involvement

Production facilities

Most if not all of the large Canadian anhydrous ammonia plants use natural gas as feedstock and as fuel for the plants' energy requirements. Canada's largest natural gas field is located in the Province of Alberta and most of Canada's ammonia plant capacity is located there. The plants are not, however, Government-owned.

Government-industry relationship

The Provincial Government of Alberta regulates the production of natural gas and a permit for a gas supply must be obtained from the Alberta Energy and Conservation Board before an ammonia plant can be built there. The Canadian National Government also consults with Provincial Governments on energy policy.

During the mid 1970's a large number of plans to build ammonia plants in Alberta were announced by U.S. companies. These plans, however, were predicated on long-term contracts for low-cost natural gas. Seeing that, in essence, these plans were the equivalent of shipping out natural gas resources, the Alberta Government approved only a few of the projects. In the interim natural gas prices had escalated and not all of the approved plants were built.

Production

Production of the principal nitrogenous fertilizers increased 78 percent, from 2.8 million short tons in 1975 to 5.0 million short tons in 1979. Anhydrous ammonia production increased 80 percent, and urea production increased 269 percent, while the production of ammonium nitrate remained almost constant during this same period. Production and trade statistics are tabulated in tables A-10 to A-16.

The competitive position of the nitrogenous fertilizer industry is based largely on the economics of ammonia production. The major factors influencing ammonia production economics are the cost of natural gas, the capital cost of ammonia plants, and the distance to markets. The capital construction cost of a new ammonia plant is higher in Canada than in the United States. The principal advantages for Canadian producers are proximity to the fertilizer consuming area of western Canada and the northwestern United States and, perhaps, lower cost natural gas. Because of the central location of the Canadian producers, most of their product moves by rail or truck to consuming areas. Also because of their location, Canadian producers are insulated to some extent from low-priced offshore ammonia imports.

Trade

Canada exports about 9 times as much nitrogenous fertilizer as it imports.

Imports

Canada is self-sufficient in nitrogenous fertilizers and imports serve a limited area where they have a freight or delivered cost advantage.

Exports

Canada exports about 40 percent of its production of nitrogenous fertilizers, mostly to the northwestern United States. Exports increased 204 percent during 1975-79. Exports of anhydrous ammonia increased 379 percent, from 128,000 short tons in 1975 to 533,000 short tons in 1979. Urea exports grew even more rapidly, increasing from 113,000 short tons in 1975 to 828,000 short tons in 1979 (an increase of 7.3 times the 1975 quantity).

Consumption

Apparent consumption of the principal nitrogenous fertilizers increased 44 percent during 1975-79. Anhydrous ammonia consumption increased 62 percent and urea consumption increased 124 percent during this same period.

Future

Expansion Plans

Anhydrous ammonia capacity in Canada is expected to increase from 2.8 million short tons in 1979 to 3.2 million short tons in 1985. 1/ Urea capacity is expected to increase from 1.4 million short tons per year in 1975 to 1.5 million short tons per year in 1983. 2/

Concern has been expressed in Canada that if there is not orderly growth in ammonia capacity, a major increase in the export of natural gas could occur in the form of the natural gas derivative, ammonia. Through consultations with provincial governments and the industry, the Canadian Department of Industry, Trade, and Commerce is pursuing the objective of orderly growth of ammonia capacity within the limits of Canada's energy policy. 3/

Demand

The demand for nitrogenous fertilizers is difficult to predict, as it can change significantly from year to year depending on weather conditions, grain prices, interest rates, farm income, acreage under cultivation, and other factors. On the basis of long-term trends, Canadian demand for nitrogenous

1/ U.S. International Trade Commission, Anhydrous Ammonia From the U.S.S.R., pub. 1050, Apr. 1980, p. A101.
2/ National Fertilizer Development Center, Fertilizer Trends 1979, Muscle Shoals, Alabama.
3/ Government of Canada, The Canadian Fertilizer Industry, Report of the Consultative Task Force, June, 1978.

fertilizers is expected to double during 1975-85 (equivalent to a compound annual growth rate of about 7 percent). This prediction is based on the assumptions that farm economics will continue to favor fertilizer use, that there will be no significant change in cropping patterns, and that an additional 13 million acres will be put in to cultivation by 1985. 1/

Trade

Fertilizer materials have a relatively low unit value. As a result, transportation and distribution cost account for a substantial part of the delivered cost of fertilizer to the farmer. Because of this, shipments of nitrogenous fertilizers historically have moved from western Canada to the northwestern regions of the United States, in addition to the western provinces of Canada. The consumption of fertilizers is highly seasonal with most deliveries made during a three to four-month period in late winter or early spring. This places a strain on transportation facilities and creates bottlenecks in the distribution of fertilizers to farmers.

Historical trade patterns seem likely to continue, in which Canadian producers gradually expand capacity in order to supply almost all of Canada's requirements for nitrogenous fertilizers. It is also likely that a substantial portion of the market for nitrogenous fertilizers in the northwestern United States will continue to be served by imports from Canada. U.S. imports of nitrogenous fertilizers from Canada are, therefore, most likely to reflect consumption trends in areas presently served by much imports.

1/ Government of Canada, The Canadian Fertilizer Industry, Report of the Consultative Task Force, June, 1978.

SYNTHETIC RUBBER 1/

Present Situation

Description and Uses

Synthetic rubbers are polymeric materials processing physical properties characterized as "elastic." Canada subscribes essentially to the Customs Cooperation Council Nomenclature (CCCN) definition which defines the term "Synthetic Rubber" to mean--

> "Unsaturated synthetic substances which can be irreversibly transformed into non-thermoplastic substances by vulcanisation with sulphur and which, when so vulcanised as well as may be (without the addition of any substances such as plasticizers, fillers or reinforcing agents not necessary for the cross-linking), can produce substances which, at a temperature between 18° and 29°C, will not break on being extended to three times their original length and will return, after being extended to twice their original length, within a period of five minutes, to a length not greater than one and a half times their original length."

Those synthetic rubbers currently being produced in Canada, according to the International Institute of Synthetic Rubber Producers, are styrene-butadiene rubber, polybutadiene rubber, butyl rubber, and nitrile rubber. Among the major types of general use synthetic rubbers not produced in Canada are ethylene-propylene rubber and polyisoprene rubber. No specialty synthetic rubbers other than nitrile rubbers are currently produced in Canada.

Styrene-butadiene rubber is the most important of the synthetic rubbers made in Canada. It is produced by the copolymerization of styrene and butadiene. This synthetic elastomer is valued for ease of processing, high abrasion resistance, and heat aging properties. Major uses include tires and other automotive products, as well as some consumer goods.

Butyl rubber is manufactured by copolymerizing isobutylene with a small amount of isoprene. It is characterized by low gas permeability, good electrical properties, resistance to ozone attack, high gum strength, and good flex and tear resistance. The primary use of butyl rubber is in the manufacture of tire tubes. Other uses include cable coverings and mechanical goods.

Polybutadiene rubber is a stereo-regular synthetic elastomer with a configuration and properties similar to those of natural rubber. It is produced by polymerization of butadiene and has good wear and abrasion resistance. It is primarily used in the manufacture of tires, where it forms part of the tread, to impart longer wear and skid resistance.

Nitrile rubber is a general term applied to all synthetic elastomers resulting from the copolymerization of acrylonitrile and butadiene. These

1/ The terms "elastomer" and "synthetic elastomer" are used as synonyms for the term "synthetic rubber" in this paper.

synthetic rubbers have very high resistance to deterioration in the presence of oils and organic solvents. Major uses for nitrile rubbers include hoses, gaskets, and seals for equipment exposed to oils and organic solvents, and in footwear.

Customs Treatment

All synthetic rubbers are classified under item number 61605-1 in the Tariff Schedules of Canada. The current rate of duty levied on imported synthetic elastomers entered into the customs territory of Canada is 2.5 percent ad valorem. This rate is about the same as the U.S. rate of 2.6 percent and is in the lower end of the world range of duties charged on these items (table A-17).

The only significant non-tariff barrier to trade between the United States and Canada consists of the discrepancy in the definition of synthetic rubber. The Canadian definition of synthetic rubber is narrower than that of the United States resulting in classification of certain specialty thermoplastic products, which are vulcanized with cross-linking agents other than sulfur, as plastic products, at a higher duty rate. This is not a problem in trade between Canada and Mexico since both countries use similar definitions for rubber. Many other countries, particularly in Europe, also use definitions for synthetic rubber similar to that used in Canada.

Structure of the Canadian Industry

There are currently two producers of synthetic rubber in Canada. According to the Rubber Industry Statistical Report (RISP) published annually by the International Institute of Synthetic Rubber Producers (IISRP), the total capacity of the Canadian synthetic rubber industry was approximately 370 million pounds per year in 1980. The Canadian subsidiary of a major U.S. chemical company is listed as having an estimated 22 million pounds of styrene-butadiene rubber capacity in Sarnia, Ontario. Construction of another styrene-butadiene facility at Varennes, Quebec, planned by this subsidiary, has been indefinitely deferred. Synthetic rubber production is a small part of the U.S. subsidiary's total Canadian operations.

The largest producer of synthetic rubber in Canada is owned and operated by an agency of the Canadian Government. This company accounted for about 94 percent of the available plant capacity for synthetic rubber in 1980. Its facilities include production capacity for styrene-butadiene rubber, nitrile rubber, butyl rubber, and butadiene rubbers. This Canadian Government company also has investments in the rubber industries of several other countries, including a 40 percent holding in Mexico's largest rubber facility. This Canadian company is a widely diversified, vertically integrated, multinational concern producing items ranging from crude oil through basic petrochemicals to a wide variety of finished products. The synthetic rubber facilities are a small part of the overall operations of this Canadian Government Company.

Technology

The synthetic rubber industry in Canada was started in concert with that of the United States during World War II. Four of the six synthetic rubber plants now operating started production in 1943. Of the other two, one was built in 1953 and the other in 1963. These plants have, in the main, been kept up to date through the installation of modern equipment. The level of technology in use in Canada's synthetic rubber industry is essentially equivalent to that in place in the United States.

Research and development efforts of the Canadian synthetic rubber industry mirror those in the United States. Efforts are directed primarily toward finding new uses for existing products, and to complying with the ever-increasing range of environmental regulations being imposed on Canadian industry. An exact figure on the size of Canadian research and development program is not available. However, the total R. and D. budget for the Canadian synthetic rubber industry is estimated to be less than 1.5 percent of gross sales. This level of spending is comparable to the estimated 1.25 percent of gross sales allocated by synthetic rubber companies in the United States for research and development.

Government Policies and Involvement

It is not difficult for foreigners to invest in the Canadian synthetic rubber industry. However, there are restrictions on importation of foreign personnel to fill jobs for which Canadian citizens are available; approval by the Government is required for formation of a company; and some other restrictive regulations also apply. But these are laws which apply to most Canadian industries. There are few, if any, restrictions aimed specifically at the synthetic rubber industry. Currently, only one non-Government owned production facility exists in Canada. This facility is owned by the Canadian subsidiary of a large U.S. chemical company. Approximately 94 percent of the production facilities for synthetic elastomers is owned directly by an agency of the Canadian Government.

Production

Production of all types of synthetic elastomers was estimated by a major trade association to have reached 550 million pounds in 1980, representing a decrease of about 10 percent from the record-high 606 million pounds produced in 1979 (table A-18). The major cause for this slippage was the slowdown in consumption of synthetic rubber by the U.S. automotive industry, the single largest consumer of Canadian synthetic rubber and rubber products. Production of synthetic rubber in Canada had increased steadily from 381 million pounds in 1975 to a record 606 million pounds in 1979. The 1979 level of production was about 87 percent of the capacity of the existing production facilities. The production capacity now in place is probably sufficient to satisfy demand for another 2 to 4 years at the currently predicted growth rates. Therefore, beyond 1984, it would appear there will be a need for new capacity.

The production trend of styrene-butadiene rubber has followed the general trend of the entire synthetic rubber industry. This is expected since this product represents over one-half of all Canadian synthetic rubber production, accounting for an estimated 333 million pounds in 1979. The trend of continued steady growth in styrene-butadiene rubber production is expected to persist because of the wide variety of products made from this rubber. There are no statistics currently available on the other individual types of synthetic elastomers manufactured in Canada. It is estimated, however, that the other synthetic elastomers made in Canada have also experienced steady growth during the past 5 years, and that this growth is likely to continue.

Trade

Canada exports about 3 to 5 times as much synthetic rubber as it imports and is expected to continue to be a net exporter of this material. The Canadian automobile industry is probably the largest single domestic customer for synthetic rubber produced in Canada. However, the nearby U.S. automotive industry is probably the overall largest single consumer of Canadian synthetic rubber.

Imports

Most of the imports of synthetic rubber into Canada in 1979 consisted of about 47 million pounds of styrene-butadiene rubber, about 19 million pounds of polybutadiene rubber, and 20 million pounds of butyl rubber. These three types of synthetic rubber accounted for over 95 percent of the approximately 90 million pounds of total imports in that year, primarily because they are the synthetic rubbers most used in those fabricated rubber products which Canada makes. The U.S. automobile industry is among the Canadian industries largest customers for these finished products. Most of the remainder of the synthetic rubber imported by Canada in 1979 was polybutadiene-acrylonitrile rubbers. Small amounts of other general and special-purpose synthetic rubbers were also imported, partly for re-export.

Exports

Canadian exports of synthetic rubber are estimated by a major international trade association to have been nearly 309 million pounds in 1979, or more than half of the 606 million pounds produced in that year. This was about 3.5 times the level of synthetic rubber imports. Canada was ranked as the seventh leading exporter of synthetic rubber in the world in 1979. Given the lack of planned expansion in the synthetic rubber industry, Canada's relative position in world synthetic rubber trade can be expected to remain static or to decline slightly over the next few years.

The largest recipient of Canadian synthetic rubber exports is the United States. In 1979 the United States imported about 166 million pounds, which represented about 54 percent of the 309 million pounds of synthetic rubber exported by Canada. The Canadian synthetic rubber industry exported to the United States about 27 percent of its entire production in 1979 in the form of raw material. Even more of the synthetic rubber produced in Canada in 1979 reached the United States as finished products, primarily automotive products.

Thus, the economic health of the Canadian synthetic rubber industry is, to a large degree, dependent on the American market, particularly the U.S. automotive industry. Other foreign major markets for Canadian synthetic rubber exports include Western Europe and Japan.

About one-half of all synthetic rubber exported by Canada is styrene-butadiene rubber. Other major types of synthetic rubber exported by Canada include butyl rubber, polybutadiene rubber, and nitrile rubbers. Small amounts of several other types of previously imported synthetic rubber are also exported.

Consumption

About 388 million pounds of all types of synthetic rubber were consumed in 1979 by approximately 155 Canadian manufacturers of rubber products. This represents an increase of about 18 percent compared with the 329 million pounds consumed by Canadian synthetic rubber fabricators in 1978. Consumption of synthetic rubber has increased steadily over the past few years and this trend is expected to continue. However, a prolonged slump in the U.S. automotive industry could have a deleterious effect on consumption, since a significant part of the synthetic rubber consumed by the Canadian fabricated rubber products industry is used to make automotive parts for export to the United States. Per capita consumption of synthetic rubber in 1979 in Canada was about 20.4 pounds, representing a slight increase compared with the 19.1 pounds in 1978. Canada's level of per capita synthetic rubber consumption is second in the world only to the 23.4 pounds per capita consumed in the United States.

Styrene-butadiene rubber is the largest-volume single type of synthetic rubber used by Canadian rubber fabricators, probably accounting for about half of the total consumption of synthetic rubber in 1979. This market dominance is likely to continue because of styrene-butadiene rubber's versatility and lower cost. Other synthetic rubbers consumed in large amounts by Canadian rubber products manufacturers include butyl rubber and polybutadiene rubber, both of which are made in Canada, and ethylene-propylene rubber which is imported.

Future

Expansion Plans

There is very little expansion planned for the Canadian synthetic rubber industry. Expansion plans have been announced by each of the two Canadian synthetic rubber producers, but only one has proceeded beyond the planning stage.

Who, what, when, why, where

A $180 million expansion of the butyl rubber facility at Sarnia, Ontario to produce halogenated butyl rubbers has been initiated by the Canadian-owned synthetic rubber producer previously mentioned. This new capacity is expected to be completed by late 1982. It is the only announced new capacity currently under construction in Canada, and will increase the Canadian-owned company's share of the domestic synthetic rubber production capacity from about 94 percent to about 95 percent of the total.

The Canadian subsidiary of a large U.S. chemical company has announced plans to build a new styrene-butadiene rubber production facility at Varennes, Quebec. The starting date for construction has since been indefinitely deferred. No other expansion or new construction plans have been announced for the Canadian synthetic rubber industry.

Impact on the industry

The expansion noted represents an increase in total Canadian synthetic rubber capacity of less than 1 percent. In 1980 the estimated capacity utilization was about 81 percent. At a projected growth rate for demand of about 4.5 percent per year, present capacity should be sufficient for the next 4 years. After that time it would appear that capacity would have to be expanded to maintain growth.

Demand

Overall, the demand for Canadian synthetic rubber has been increasing. However, The Canadian synthetic rubber industry is economically dependent to a large extent on the United States market, particularly the American automotive industry. A prolonged slump in that market could significantly reduce the rate of growth of the Canadian synthetic rubber industry.

Forecast growth

The Canadian demand has been forecasted by several sources to be in the neighborhood of 4.5 percent per year through 1983. This is comparable to the forecasted rate of increase in the United States and Western Europe, areas in which the synthetic rubber industries are in a state of maturity similar to that in Canada. This rate of demand growth is lower than the world average rate of demand growth which is projected at about 5.3 percent per year and well below the 8 percent per year projected for lesser developed countries and the 7 percent per year growth predicted for centrally planned economy countries.

Reasons for growth

Growth in the synthetic rubber industry in Canada, as well as in the rest of the world, is primarily a function of growth in the transportation sector which consumes almost two-thirds of all synthetic rubber. Since the U.S. automobile industry is such a significant market for Canadian synthetic rubbers and rubber products, the current slowdown in production of American automobiles and production of smaller, longer wearing tires, among other factors, would seem to indicate a relatively low growth rate.

Another factor which may have some effect on the growth in demand for Canadian synthetic rubber is the effort currently being made to increase economic independence by expanding international trade in these commodities with countries other than the United States. The main thrust of this effort seems to be aimed at developing countries in South America. Industrial development requires, among other things, more and better methods of transportation. This would indicate that developing countries undergoing industrial expansion are likely to be areas in which new markets can be established. Competition could be strong since several Western European countries also have significant international trade in synthetic rubbers and may be looking for new markets. Some Eastern European countries currently have extensive capacity expansion programs under way. Ostensibly, these are efforts to become more self-sufficient in the manufacture synthetic rubbers, but some of this new capacity could also pose significant competition for markets in developing countries around the world.

Relationship to the United States

The United States has been a major market for Canadian synthetic rubber and rubber products for many years, a situation that is expected to continue. However, efforts are currently being made to broaden Canada's trade in synthetic rubber with countries other than the United States. This is an effort to reduce the Canadian synthetic rubber industry's economic dependence on the American market. The United States is also a major competitor with Canada in the international trade of synthetic rubber. The Canadians manufacture only a limited number of synthetic rubber types and some broadening of the range of types produced may be necessary to compete more successfully in the international marketplace.

Barriers to trade in synthetic rubber between Canada and the United States are relatively minor. Tariff rates are similar, 2.5 percent ad valorem in Canada and 2.6 percent ad valorem in the United States. There is some discrepancy in what each country defines as synthetic rubber, resulting in some products which are classified as synthetic rubber in the United States being considered plastics in Canada. Since plastics generally have higher rates of duty, this could act as a deterrent to trade in some products. Overall, however, the barriers to trade in synthetic rubber are small and further reductions would be expected to have little impact on trade between the two countries.

Relationship to Mexico

The largest Canadian synthetic rubber producer owns 40 percent of the largest synthetic rubber company in Mexico. This gives the Canadian company ownership of more than 20 percent of all Mexican synthetic rubber production capacity. Mexico has high tariff rates and other strong barriers to trade particularly in those types of synthetic rubber produced in Mexico. Since the types of synthetic rubber produced in Canada are principally the same types most vigorously protected by Mexico, a reduction in tariff rates and relaxation of other trade barriers could open a significant new market to Canadian synthetic rubber producers. However, competition for this market, particularly from U.S. manufacturers, could be stiff.

Trade

International trade patterns for Canadian synthetic rubber are not expected to change markedly within the forseeable future. The most important foreign market for Canadian synthetic rubber will probably continue to be the United States. Western Europe and Japan will also continue to be important consumers of Canadian synthetic rubber. Expansion of trade with developing countries, particularly in South America, is expected as an effort is made to reduce the influence of the U.S. market on the Canadian synthetic rubber industry. Some increase in trade with Mexico may occur if the aforementioned Mexican barriers to trade in the types of synthetic rubber produced in Canada are reduced, although the proximity of U.S. manufacturing facilities to Mexico is expected to allow continued dominance of the available Mexican market by American manufacturers.

MANMADE FIBERS FROM PETROCHEMICALS

Present Situation

Description and Uses

Manmade fibers in Canada are produced in the same way as in the United States and formed into single filaments or groups of continuous filaments (tow) or filaments cut into short lengths (staple). Canada also produces the six major types of manmade fibers: polyester, nylon (polyamide), acrylic, olefin (polypropylene and polyethylene), cellulosic (rayon and acetate), and glass. The petrochemical types, the first four listed above, are the major topics of this study. Cellulosic fibers, which are formed partly from petrochemical derivatives, will be discussed in less detail.

Nylon fibers and yarns account for over 40 percent, or 145 million pounds, of the Canadian output of such products from petrochemicals. Nylon filament yarn and staple fiber are the most popular forms manufactured in Canada; the former is used mostly in hosiery, the latter, in carpets.

Polyester fibers and yarns supply over a fourth, or 88.4 million pounds, of the Canadian production of manmade fibers from petrochemicals. They are produced mainly as filament yarns which are normally textured and used chiefly in knit goods. However, considerable quantities of yarn are also made into woven fabrics for apparel and industrial products. Substantial quantities of polyester staple and tow are also produced and manufactured into yarn mainly for apparel and industrial uses.

Olefin fibers and yarns rank third in production (70.6 million pounds in 1979) in Canada and are used principally for cordage and as backing for carpets. Acrylic fibers and yarns are last (about 34.2 million pounds in 1979); as raw fiber they are produced only in staple form which is eventually converted into yarns used mainly in sweaters.

Customs Treatment

Tariff

Manmade fibers and yarns are dutiable under the Canadian Customs Tariff in three major categories: as "fibres" or filaments not exceeding 12 inches in length, as tow (uncut grouped filaments), and as yarn. The range of rates of duty on the important types is shown in the following tabulation:

Abbreviated description	Present rates of duty 1/	Final negotiated rates of duty 1/
Nylon, polyester, and acrylic yarn	Free; 7.5%-12.5% ad val.; 10-11¢ per lb.	7.5% - 12.5% ad val; 5¢ per lb.
Acrylic and polyester fibers	10% ad val.	8.5% ad val.

1/ Most-favored-nation rates of duty.

Nylon, acrylic, or polyester staple fibers are dutiable presently at 10 percent ad valorem with a final Multilateral Trade Negotiation (MTN) rate of 8.5 percent ad valorem. Nylon or polyester yarns are generally dutiable at 10 percent ad valorem or 10 cents per pound with a final MTN rate of 10 percent ad valorem or 5 cents per pound. These five important types account for most of the Canadian production and foreign trade in manmade fibers and yarns from petrochemicals.

Non-tariff barriers

Quotas established through the Arrangement Regarding International Trade in Textiles (MFA) are available to the Canadian Government. The MFA can control imports of manmade fiber yarns from some of Canada's suppliers but not raw fibers.

Structure of the Industry

The leading firm producing manmade fibers and yarns from petrochemicals is estimated to account for over a third of the Canadian production capacity; the top four firms supply most of the raw manmade fiber capacity; and the eight largest furnish almost all the capacity for producing extruded fibers and about a third of the yarn capacity. The percentage of capacity accounted for by dominant firms in the five principal types of manmade fibers and yarns from petrochemicals is shown in the following tabulation:

Type of manmade fiber	Percentage of capacity accounted for by the leading--		
	1 firm	4 firms	8 firms
Nylon yarn	30	50	60
Polyester yarn	40	60	70
Nylon staple fiber	70	100	-
Acrylic staple fiber	100	-	-
Polyester staple fiber	100	-	-

Source: Estimated by USITC staff.

Ownership

All Canadian firms making raw manmade fibers from petrochemicals are owned by foreign companies, especially those of the United States. About one-fourth of the yarn firms are also foreign-owned, particularly by multinational firms headquartered in the United States. The foreign firms gear their capacity utilization according to Canadian market demands although some are encouraging more exports by their Canadian subsidiaries.

Integration

Two of the firms producing manmade fibers are integrated forward to making fabric. In addition, many of the firms producing manmade fibers are integrated backward to making petrochemicals. A few of the yarn firms manufacture other textile products, but even less extrude fibers. Horizontal integration, i.e., processing of like products by manmade fiber producers, does not exist commercially in Canada.

Foreign investment

U.S. multinational firms dominate Canadian production of manmade fibers. However, Canadian firms control about two-thirds of the yarn mills. The more important fiber-producing firms generally manufacture chemicals and a variety of other products. Less than 20 firms manufacture raw fibers, but over 40 manufacture yarns.

Technology

Because most fiber production from petrochemicals in Canada is by American subsidiaries or affiliates, the technology developed by the U.S. firms is used in Canada. However, the Canadian subsidiaries have developed some fiber processes of their own such as polypropylene for carpets and upholstery. For most fiber production in Canada, nevertheless, the technology used is generally by licensing agreements with U.S. firms.

In manmade fiber yarn, process development and process break-throughs applied in Canada were obtained mostly from other countries, especially the United States. Canada imports most of its yarn machinery. Here also, improvements were developed in foreign countries. However, Canadian firms developed the world's first polypropylene fabric for upholstery and, in the process, created the yarns to make the fabric.

Canadian manmade fiber firms spend very little on research and development because expenditures of this type are borne primarily by their non-Canadian parent companies.

Government Policies and Involvement

Production facilities

The Canadian government is in no way involved in the manufacture of manmade fibers. All production facilities are in the private sector.

Government-industry relationship

Three Canadian departments generally handle most of the promotion or controls in the production, exports, and imports of petrochemical fibers: National Health and Welfare, Consumer and Corporate Affairs, and Industry, Trade and Commerce.

The Department of National Health and Welfare is involved with safety and health standards and environmental protection activities. The Canadians first monitor environmental and occupational hazards, then set the standards which firms must abide by within a certain period of time.

The Department of Consumer and Corporate Affairs administers legislation and regulations pertaining to corporations relative to mergers, monopolies, and restraint of trade activities. It also administers laws pertaining to patents, trade marks, and similar product protection.

The Department of Industry, Trade and Commerce becomes involved in domestic production by actively stimulating the establishment, growth, and efficiency of manufacturing industries including manmade fibers and yarns from petrochemicals. It develops export trade, formulates external trade policies, gathers information, and offers financial assistance for these products.

Two independent agencies, the Restrictive Trade Practices Commission and the Export Development Corporation, are closely involved in the domestic production and exports of these products. The former conducts investigations upon complaints from domestic organizations and makes fact-finding reports directly to the Prime Minister. The latter is a Crown agency reporting to Parliament; it provides insurance, guarantees, loans, and other financial facilities to help Canadian exports.

The major import controls in Canada are quotas established through the Arrangement Regarding International Trade in Textiles (MFA) and antidumping procedures. The MFA can control imports of manmade fiber yarns from some of Canada's major suppliers but not raw fibers. Antidumping procedures are handled by an Anti-Dumping Tribunal which investigates and establishes remedies for less-than-fair-value imports.

Production

Canadian production of manmade fibers from petrochemicals since 1974 is shown in the following tabulation:

Type	1975	1976	1977	1978	1979
	In million of pounds				
Noncellulosic yarn (nylon, polyester, others)	141.8	140.7	152.8	159.2	161.2
Noncellulosic staple fiber (nylon, acrylic, and polyester)	69.5	72.3	93.7	112.2	106.9
Olefin fibers	72.8	66.2	70.6	68.4	70.6
Total	284.1	279.2	317.1	339.8	338.7

Source: Textile Organon.

Nylon yarn (monofilaments, grouped filaments, and spun) is the largest type of manmade fiber produced in Canada, accounting for over a fourth of the total fiber and yarn production from petrochemicals. It increased from an estimated 85 million pounds in 1975 to 95 million in 1979. Polyester yarn (grouped filaments and spun) was second, rising from an estimated 55 million pounds in 1975 to about 65 million in 1979. Nylon staple ranked third, increasing from an estimated 23 million pounds in 1975 to about 50 million in 1979. Production of nylon staple more than doubled during the 1975-79 period principally because of its expanded use in carpets.

Trade

Imports

Since the 1960's, Canada has imported annually more manmade fibers from petrochemicals than it has exported (table A-19). During the 1975-79 period, imports furnished over a third of the consumption of these fibers, and ranged from 110 million pounds in 1977-78 to 187 million pounds in 1979. Imports of major products from 1977 to 1979 are shown in the following tabulation:

(Quantity in million pounds; value in million Canadian dollars)

Type of fiber	1977	1978	1979
		Quantity	
Nylon yarn	31.0	24.5	41.9
Polyester yarn	14.3	25.1	38.2
Acrylic fibers	25.9	28.9	34.7
Polyester fibers	27.8	32.1	41.9
Acrylic yarn	13.7	10.4	13.0
		Value	
Nylon yarn	$45.6	$40.9	$74.0
Polyester yarn	18.2	28.8	48.5
Acrylic fibers	17.8	22.1	29.6
Polyester fibers	16.4	19.5	28.3
Acrylic yarn	20.0	16.4	24.7

Source: Official statistics of the Minister of Industry, Trade and Commerce.

Exports

Exports ranged from 7.7 million pounds in 1977 to 37.9 million in 1978 during the 1975-79 period. They have been mainly nylon yarn and acrylic and polyester fibers. Only in 1978 and 1979 have exports exceeded 10 percent of domestic production (table A-19). Value of exports of manmade fibers from petrochemicals has been estimated at $26 million in 1978 and $23 million in 1979.

Sources and markets

Canadian imports of manmade fibers from petrochemicals have been furnished overwhelmingly by the United States. The U.S. furnished most of the imports of nylon yarn, polyester yarn, acrylic fibers, polyester fibers, nylon fibers, and polypropylene yarn. It was the largest supplier of acrylic yarns followed by Japan and the Republic of Korea. Canada's chief exports of manmade fibers from petrochemicals went to the United States--which ranked as the best market for most types--Taiwan, the United Kingdom, Australia, and India.

Consumption

Apparent Canadian consumption of manmade fibers from petrochemicals increased irregularly from 318 million pounds in 1975 to 423 million pounds in 1979 (table A-19). The increase has been attributed principally to the expanded use of textured yarns and the use of manmade fibers (especially nylon and olefin) in carpet facing and backing. Canadian consumption of manmade fibers from petrochemicals was estimated at $380 million in 1979.

Future

Expansion Plans

Through 1985, there have been no official announcements of expansion plans for Canadian production capacity of manmade fibers from petrochemicals. Unofficial sources have indicated that capacity for these fibers in Canada will remain about the same for the next 5 years. Present capacity for three major fibers produced in Canada is shown in the following tabulation:

Type	Capacity (In millions of pounds)
Nylon fibers-------------------	200
Polyester fibers---------------	200
Acrylic fibers-----------------	25

Source: Textile Organon and other sources.

Demand

Forecast growth

In the next decade, demand for manmade fibers from petrochemicals in Canada will grow at annual compounded growth rate of under 3 percent. Most of the growth will be attributed primarily to an increase in per capita consumption of manmade fibers and to a lesser extent to the increase in population and to new uses.

Nylon fibers are anticipated to achieve a growth of just under 5 percent annually from 1980 through 1985; however, from 1985 through 1989, the yearly growth rate will decline to around 3 percent. The chief growth in nylon fibers in the next decade should be in carpets, although other markets such as hosiery will show some growth; however, the Canadian use of nylon tire cord is expected to remain static through the decade. Consumption of nylon fibers is expected to reach 190 million pounds in 1989.

Growth in polyester fiber consumption in the next five years is projected to be minimal. The future growth of this fiber in Canada is dependent on how the industry can compete with imports which have restricted consumption in the past 5 years. Polyester fibers in Canada are used predominantly in apparel where the possible growth in consumption is expected. From 1984 to 1989, however, growth in Canadian consumption of polyester fibers should not exceed that achieved from 1980 to 1985; the problems here appear to be the restricted Canadian capacity and the possibility of higher imports.

Acrylic fiber consumption is predicated to rise 3 percent annually from 1980 to 1984. This increase will be furnished mainly by existing facilities and imports. From 1984 to 1989, the growth is projected to remain at 3 percent annually and reach 80 million pounds in 1989. Acrylic's growth is anticipated mainly in apparel which presently takes three-fourths of Canadian consumption.

Relationship to the United States and Mexico

The overall growth rate from 1980 to 1990 for Canadian consumption of manmade fibers from petrochemicals is anticipated to be about 3 percent annually compared to 2 percent for the United States, 10 percent for Mexico, and 3 percent for other nations covered here. Per capita consumption is forecast to rise to 31.9 pounds in 1990 for Canada, 42.5 for the United States, 18.5 for Mexico, and 3.6 pounds for the other countries covered by this study.

Trade

Changes in imports and exports

Future expansion of producing capacity for manmade fibers from petrochemicals is not predicted for Canada at this time. However, consumption of these fibers is expected to grow annually about 3 percent. Much of this consumption can be furnished by present fiber facilities but a substantial part will continue to be furnished by increased imports. Canadian exports are expected to decline somewhat from the records set in 1978 and 1979, with the result that more production will be directed to the domestic market.

Likely new trading partners

Most of the imports of manmade fibers from petrochemicals in the next decade will probably be supplied by the United States. Other potential suppliers include Japan, the Republic of Korea, and the European Community, especially the United Kingdom.

In the next decade the United States should remain the best market for Canadian exports of manmade fibers from petrochemicals. A strong influence here is that U.S. firms control most of the producing facilities for these fibers in Canada.

Impacts on producers, consumers, and new uses

Canada has ample petroleum reserves to supply the manmade fiber industry for many years to come. Pressure to export more crude oil will no doubt come from the United States and other petroleum-deficient countries. This pressure may force the price of petroleum to rise in Canada, and in turn, make it more expensive to produce manmade fibers from petrochemicals. The feedstock price increases, however, are not expected, in the next decade, to deter petrochemical fiber production in Canada since the increases will only nominally raise the selling price of manmade fibers.

Canadian consumption of manmade fibers from petrochemicals is more limited by available market than by the potential price increases. Canadian mill fiber consumption is relatively low due to the extremely high level of import penetration of finished fabrics as well as apparel from Asia and the United States.

CELLULOSIC FIBERS

Present Situtation

Description and Uses

Only acetate yarn and rayon staple are produced in Canada. Rayon staple ranks below olefin production in Canadian manmade fiber production and accounts for about one-fifth of all the manmade fiber output. It is used chiefly in apparel and, in lesser quantities, in home furnishings and industrial goods. Acetate yarn accounts for less than one-tenth of Canadian manmade fiber production and is used mainly for apparel and home furnishings.

Customs Treatment

Cellulosic fibers and yarns are dutiable under the Canadian Customs Tariff as (1) "fibres" or filaments not exceeding 12 inches in length, as (2) tow (uncut grouped filaments), and as (3) yarn. The range of rates of duty on the two important types in Canada is shown in the following tabulation:

Abbreviated description	Present rates of duty 1/	Final negotiated rates of duty 1/
Acetate yarn	Free; 7.5%-12.5% ad val; 10-11¢ per pound	7.5%-12.5% ad val; 5¢ per pound
Rayon staple fiber	10% ad val.	8.5% ad val.

1/ Most-favored-nation rates of duty.

Structure of the Industry

The only producer of acetate yarn in Canada is owned 57 percent by a company headquartered in the United States. The only producer of rayon staple in Canada, is owned entirely by a company headquartered in England. Over 20 firms manufacture cellulosic yarns in Canada; more than one-third of them are owned by foreign companies.

The acetate yarn producer also manufactures chemicals and textile fabrics, while the U.K. company is also involved in the manufacture of other chemicals. Most of the cellulosic yarn companies also make fabrics.

Technology

Both cellulosic fiber producing firms have the technology of their parent firms available for their use in Canada. One of the firms, however, developed a melt-extruded triacetate for carpets on its own through research and development in Canada. Yarn technology is usually licensed from other countries, especially the United States and the United Kingdom; however, a large Canadian firm producing yarns has developed a number of improvements in converting and spinning yarn into textiles. But Canadian firms still import most of the machinery used in making the yarns.

Canadian companies producing cellulosic fibers and yarns spend small sums in the research and development of these products. They are believed to average less than the firms making petrochemical fibers and yarns.

Government Policies and Involvement

In production, export promotion, and import control of cellulosic fibers and yarns, government policies and involvement are the same as for the petrochemical fibers. 1/ In general, the Canadian Government is involved more in trade problems and export promotion and is less stringent on production controls, especially environmental protection requirements.

Production

Canadian production of cellulosic fibers since 1974 is shown in the following tabulation (in millions of pounds):

Type	1975	1976	1977	1978	1979
Rayon staple	32.2	46.7	57.8	59.1	69.0
Acetate yarn	28.9	12.6	24.3	27.1	31.1
Total	61.1	59.3	82.1	86.2	100.1

Source: Textile Organon.

Rayon staple is the second largest type of manmade fiber produced in Canada. In addition, it showed the greatest production increase of all manmade fibers, rising from 32.2 million pounds in 1975 to 69.0 million pounds in 1979. The increase is unusual since other important producing countries, including the United States, have shown minimal, moderate, or even declining production of rayon staple. The increase is attributed to the following: (1) 1975 was a very low production year, following 1974 when production almost reached 60 million pounds; (2) the one producer in Canada obtained large export markets for its staple; and (3) demand for rayon staple in Canada expanded during the 1975-79 period, particularly in the use of high wet strength fibers (table A-20).

1/ See the petrochemical fiber section of this report for a detailed discussion of Canadian government policies and involvement in manmade fibers.

Trade

Imports

Canadian imports of cellulosic fibers increased from 11.5 million pounds in 1975 to 43.9 million pounds in 1978, then declined to 28.0 million pounds in 1979. Imports of extruded yarns and staple fluctuated; yarn imports reached their peak in the 1975-79 period of 20.5 million pounds in 1977 and staple, 24.9 million pounds in 1979 (table A-21).

Exports

Canadian exports of cellulosic fibers more than tripled from 17.4 million pounds in 1975 to 57.6 million pounds in 1979 (table A-20). Most of the increase was due to one company's expansion of its rayon staple exports from 1975 to 1979. Total cellulosic staple exports almost quadrupled from 13.0 million pounds in 1975 to 48.3 million pounds in 1979 (table A-21).

Consumption

Apparent consumption of cellulosic fibers in Canada fluctuated during the 1975-79 period reaching a low of 55.2 million pounds in 1975 and a high of 104.9 million pounds in 1978. Consumption is highly dependent on the demand for rayon staple, and since 1974, rayon staple's demand has fluctuated, particularly in its uses for apparel and carpeting (table A-20).

Future

Expansion Plans

There is no information on whether the acetate yarn plant will expand from its 31.9 million pounds capacity in 1980. Textile Organon, however, has indicated that the rayon staple plant is expected to expand from a capacity of 71.0 million pounds in 1980 to 74.1 million pounds in 1981. No official announcements have been made as to whether other firms intend to establish a cellulosic fiber plant in Canada within the next 5 years.

Demand

Forecast growth and reasons

Trade sources predict that consumption of cellulosic fibers, which are mainly manufactured from wood pulp of which Canada is one of the world's largest producers, will increase to about 130 million pounds by 1985. Part of the increase will be furnished by imports, but most will be supplied by an increase in domestic production.

Relationship to United States and Mexico

Per capita consumption of cellulosic fibers in Canada is expected to increase over one-third from 7.3 pounds in 1974 to 9.9 pounds in 1990. The increase is greater than for the United States where per capita consumption expected to rise only from 5.3 pounds in 1974 to 6.8 pounds in 1990. However, the Canadian growth rate of per capita consumption will be less than that of Mexico which is forecast to expand from 1.1 pounds in 1974 to 3.5 pounds in 1990. Canada's per capita consumption of cellulosic fibers is expected to increase more than that of the United States because of an increasing consumer interest in wash-and-wear apparel made from these fibers. The expected per capita increase is less than in Mexico because the Mexican consumer is just beginning to realize the advantages of cellulosic fibers in apparel and industrial uses relative to similar products made from cotton.

Trade

The future expansion planned by the one domestic producer should cover Canada's additional needs for rayon staple fiber. The acetate yarn producer is not expected to increase capacity within the next 5 years although the firm is presently operating at over 90 percent of capacity. The increase in acetate yarn consumption is therefore anticipated to be supplied chiefly by imports, especially from the United States. The other types of cellulosic fibers now in use in Canada are expected to be entirely supplied by imports, particularly from the United States.

PLASTICS

Present Situation

Description and Uses

The principal resins of Canada are also the leading resins produced worldwide. These include high density polyethylene (HDPE), low density polyethylene (LDPE), polypropylene (PP), polystyrene (PS) and polyvinyl chloride (PVC). They are thermoplastic materials 1/ and represent about three-fourths of the Canada's plastics output and about two-thirds of its domestic consumption 2/ with the difference accounted for by imports.

To a lesser extent Canada also produces other resins common to the world market, including, but not limited to phenolic resins, polyester resins, polyvinyl acetate, urea resins and melamine resins. However, due to its relatively small population of 23.5 million in 1978 3/ and therefore a rather limited domestic market, certain speciality plastics such as polyacetal resins, polycarbonate resins, polyphenylene oxide are supplied to Canada by foreign producers.

Consumption of plastics in Canada, as in the United States, is largely accounted for by four major markets: 4/ (1) packaging; (2) building and construction; (3) home and commercial furnishings; and, (4) transportation. A brief discussion of each of these markets follows:

Packaging

This market, which is the leading single market for plastics in both Canada and the United States, includes such diverse products as milk bottles, meat and poultry wraps, medical packaging, and trash bags. Plastics used in packaging accounted for 36 percent of total plastics consumption in Canada in 1975 but during the period 1980-85, is expected to decline slightly to 33 percent. In the United States plastics used in packaging in 1979 accounted for about 27 percent of total plastics consumption.

Building and construction

This market, the second most important market for plastics in Canada, includes such products as pipe and pipe fittings and window frames. The building and construction and related industries accounted for 19 percent of

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1/ Thermoplastic materials are those which in their final state as finished articles can be repeatedly softened by heat and hardened by a decrease in temperature.

2/ Estimates furnished by an official of the Society of the Plastics Industry of Canada (Don Mills, Ontario).

3/ Predicasts, Inc., WORLD-regional-CASTS, Cleveland, September 19, 1979, pp. A-2 and A-8.

4/ Chemicals Branch, Department of Industry Trade and Commerce (Ottawa), Plastics Processing Industry-End-Use Market Analysis, December 1976.

total Canadian consumption of plastics in 1975 but is expected to increase to 22 percent in 1980, and by 1985, it is expected to reach 24 percent or more of total consumption. U.S. consumption of plastics in this market in 1979 accounted for about 20 percent of total U.S. plastics consumption.

Home and Commercial furnishings

Plastics in this market are used in such products as refrigerators, other appliances, and wall coverings. They accounted for 9 percent of total plastics consumption in 1975 but are expected to decline slightly to about 7 percent in both 1980 and 1985.

Transportation

Plastics in this market are used principally in automobile components. They accounted for 7 percent of total Canadian plastics consumption 1975 but are projected to reach 9 percent in 1980 and increase to 10 percent or more by 1985.

Customs Treatment

Canada is committed broadly to the principles of the General Agreement on Tariffs and Trade (GATT).

Tariffs

Prior to the most recent Multilateral Trade Negotiations (MTN) known as the Tokyo Round (see table A-22), Canada's Most Favored Nation (MFN) base rate of duty on the leading plastics materials was, depending on the products form, either 12.5 percent or 10 percent ad valorem. As a result of the MTN agreement, the MFN concession rate on many of the major resins such as polyethylene and polypropylene will decline either from 12.5 percent to 11 percent or from 10 percent to 9.5 percent, depending on the resins form. 1/ Therefore by January 1, 1987, the overall reductions will amount to twelve percent and five percent, respectively. It was reported in a Commission study 2/ that the average depth of the cut by Canada for dutiable imports of plastics materials from the United States was 18 percent. However, Canadian offers actually resulted in a negligible reduction in the average tariff rate applicable to imports of plastics materials since in many instances Canada's applied rate is presently lower than its concession rate.

Although a member of GATT, Canada is not associated with any trading bloc. Canadian products, however, have enjoyed Commonwealth tariff

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1/ Annex-Schedules of Contracting Parties and the EEC V Canada, Geneva (1979) protocal to the General Agreement on Tariffs and Trade June 30, 1979 (Geneva), pp. 187-188.

2/ MTN Studies: A Report Prepared at the Request of Committee on Finance of the United States Senate and its Subcommittee on International Trade on Investigation No. 332-101 . . ., 6- part 5, August 1979, p. 117.

preferences in some countries including the United Kingdom, Australia, New Zealand, and South Africa. The reciprocal preference agreement between the United Kingdom and Canada ended on July 1, 1977 when United Kingdom tariffs were fully adjusted to those of the EEC. 1/

Non-tariff barriers

Non tariff barriers (NTB's) are not a hindrance to plastics entering Canada. Certain provinces, such as Ontario and Quebec, however, will pay as much as a 10 percent premium on goods sourced anywhere in Canada and British Columbia's purchasing policy is openly preferential towards its own goods. 2/ Up to a 10 percent premium is paid on such goods, and up to a 5 percent premium is paid on goods from the other areas of Canada. The Canadian Federal Government will also pay up to a 10 percent premium for goods manufactured domestically. These incentives are similar to the "buy American" policy implented by Governments in eleven states in the United States. 3/

Structure of the Industry

There are about 20 producers of plastics in Canada operating approximately 45 establishments. Virtually all of Canada's plastics industry is located near Montreal, Quebec; Sarnia, Ontario; and Edmonton, Alberta. 4/ This industry employed 3,211 production and related workers in 1978, down by 2 percent from 3,281 such workers in 1977. 5/

Ownership

Information developed during field work revealed that more than four-fifths of Canada's plastics industry is foreign owned with U.S. based multinational firms (MNF) representing about three-fourths to four-fifths of

1/ Dean Rusk Center, Comparative Facts on Canada, Mexico, and the United States: A Foundation for Selective Integration and Trilateral Cooperation, Athens, Georgia, 1979, p. 107.

2/ Speech by David Collenette, Society of the Plastics Industry of Canada, "SPI 'Shop Canada' Program," at First Annual Canadian Outlook Conference on Resin Supply/Demand, Toronto, Canada, Nov. 15, 1979.

3/ Harold von Riekhoff, John H. Sigler and Brian W. Tomlin, Canadian-U.S. Relations: Policy Environments, Issues and Prospects, Canada-U.S. Prospects, a series sponsored by C.D. Howe Research Institute (Canada) and National Planning Association (U.S.A.), printed in Canada, December, 1979, p. 77.

4/ In fact these three locations account for nearly all Canada's petrochemical industry.

5/ Statistics Canada, Manufacturers of Plastics and Synthetic Resins 1978, May 1980, p. 6.

this foreign ownership. The remaining foreign representation is accounted for by European MFN's. 1/

Leading plastics producers in Canada, like those in the United States, are for the most part major chemical or petroleum firms. There are several key plastics producers however, whose parent company is outside of the chemicals or petroleum industry, and in such industries as food processing or rubber goods.

Since Canada's domestic market is much smaller than that of the United States (24 million people versus 223 million people), usually only a handful of firms can economically produce each of the major resins. This compares to the dozen or more producers of each major resin in the United States. For example, in 1979, Canada had but 3 producers of HDPE, 4 producers of LDPE, 2 producers of PP, 3 producers of PVC and 5 producers of PS. 2/ Typically the leading producer represents between two-fifths and three-fifths of the stated capacity. 3/ Canada has an aggregate of 17 producers of the major commodity resins. Some firms produce more than one of the major resins; therefore, there are only 13 firms when duplication is removed.

Integration

Nearly all of the polyethylene and polypropylene producers are integrated back to the starting materials ethylene and propylene, either on their own or through joint ventures. Two of the 5 polystyrene producers make the intermediates, ethylbenzene and styrene. None of the PVC producers make the consecutive intermediate materials, ethylene dichloride or VCM, but two are basic in ethylene, one of the two raw materials. Forward integration is more

1/ "Dividends paid or credited, to non-residents by a corporation which has a 'degree of Canadian ownership' are subject to a reduction of 5 percentage points of the applicable withholding rate, i.e. to 20% or 10%. A corporation has the required degree of Canadian ownership if throughout any 60-day period in the 120-day period commencing 60 days before the first day of a taxation year. (1) The Corporation was resident in Canada; (2) Either--(a) at least 25% of the issued and outstanding fully voting shares and equity shares representing 25% of the issued and outstanding equity paid-up capital were beneficially owned by Canadian resident individuals or corporations controlled in Canada, or (b) for corporations whose shares were listed on a Canadian stock exchange, no single non-resident shareholder, either alone or in combination with any other related person, owned more than either 75% of the issued and outstanding equity shares; and (3) At least 25% of the corporation's directors were Canadian residents. 'Equity' shares are defined at some length to include all shares other than conventional redeemable preferred shares.
Withholding taxes are subject to the effect of any applicable international tax agreements." Canada has international tax agreements with many countries including the United States. From Margot J. Fawcett, editor/-publisher, The 1979 Corpus Almanac of Canada, Canada, 1979, pp. 10-26.

2/ "The Plastics Industry in Canada," Kunststoffe, Munchen, West Germany, vol. 69, Oct. 1979, p. 38 (pp. 664-665 of German edition).

3/ A far greater dominance than in the United States where the capacity leader represents from about 15 percent to about one-fourth of the total.

limited and is usually restricted to the fabrication of basic shapes like film, sheet, other profile forms, or pipe. The basic resin producer does not typically compete with his customer, the plastics fabricator for the end product market.

During the period 1975-79 total plastic's capacity utilization varied from 70 percent to 75 percent in 1975, to well over 80 percent in 1976-78, and increased to 90 percent in 1979. However, because of its limited market size, the installation of even one additional world class plastics plant takes care of domestic Canadian need for 3-5 years and reduces demand down to about two-thirds of name-plate capacity. 1/ In so doing, it forces Canadian producers to look at exports as the only alternative to underutilization.

Separate statistics are not available for foreign investment in the plastics industry in Canada. However, since over four-fifths of Canada's chemical industry is foreign controlled, 2/ any large expansion program is necessarily heavily financed from abroad.

Technology

Industry sources report that virtually all of Canada's plastics technology comes from the United States and Western Europe, principally Great Britain and West Germany. Some U.S. firms operating in Canada develop technology locally and exchange it for royalties. Canadian industry leaders have encouraged licensing of U.S. technology in Canada to aid development of larger markets. 3/ Separate data are not available for research and development (R. & D.) expenditures and programs for the plastics industry.

Government Policies and Involvement

Production facilities

The Canadian Government is the principal owner of two leading petrochemical producers. One is a major producer of petrochemicals and resins; while the other one is an important source of petrochemical and resin feedstocks.

1/ "Canada offers Resin, Machinery, Molds, Markets-and Rivalry," Modern Plastics, June 1980, pp. 108-109, and also from a speech by Thomas H. McGreevey, SRI International, Chemical Industries Centre, "World Outlook on Thermoplastics," at the First Annual Canadian Outlook Conference on Resin Supply/Demand, Toronto, Ontario, Nov. 15, 1979.

2/ B. W. Wilkenson, Canada in the Changing World Economy, Canada-U.S. Prospects, a series sponsored by C.D. Howe Research Institute (Canada) and National Planning Association (U.S.A.), printed in Canada, April 1980, p. 73. Also based on information obtained during field work.

3/ Chemistry in Canada, Ottawa, July 1978, pp. 28-32.

Government-industry relationship

Government involvement in all industries accelerated with the release of the Gray report in 1972. 1/ Subsequent to this report, Canada established the CDC in 1972.

There are no official import controls as such on plastics. However, most of the provinces have"buy Canada" laws comparable to the "buy American" laws here. These laws have not affected the level of trade in plastics. Canada also employs a large " value added tax" on manufactured goods, both domestic and imported, which is paid by the manufacturer. The rate currently stands at 9 percent; however, this tax affects the products of plastics, not plastics themselves.

There are no statistics available to show the costs of environmental regulations on the plastics industry alone.

Shipments

Official Canadian data are for shipments, not production. The shipment statistics reported on volume basis are for selected, key resins only 2/. The official statistics for the value of shipments reportedly includes all plastics and is shown only in the aggregate. 3/

Plastics shipments in Canada of select resins increased from 862 million pounds in 1975 to 1,963 million in 1979 (table A-23) or at an average annual rate of growth of 23 percent. The value of shipments increased from $423 million in 1975 to $723 million in 1978, or at an average annual rate of 20 percent. Polyethylene resins are the most important of the plastics shown separately, accounting for about two-thirds of the volume of domestic shipments in 1978 and 1979 (table A-24). The shipments of polyethylene resins

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1/ Report entailed a redefinition of the economic and political costs to Canada of foreign direct investment and an emphasis on Canada's own industrial development objectives. The report argued in favor of Canadian national high technology industrial structure. The Foreign Investment Review Act (FIRA) of 1973 was passed as a result of this report. FIRA's salient provision provides for the review of the operations of foreign or foreign controlled investors.

2/ These are polyethylene resins, polystyrene resins, PVC resins and unsaturated polyester resins. Based on data in Kunststoffe, op. cit., p. 38, the shipments of these selected resin annually represented about 70 percent of total plastics production for the years 1976-78. These key resins also represented about 70 percent of total plastics consumption in 1976-77, and fell to 59 percent of the total in 1978.

3/ An official of the Society of the Plastics Industry of Canada claims that the total value is understated by 30-40 percent annually. This results from Statistics Canada publishing data on the basis of an "establishment concept." Under this concept, shipments of all goods from a plant or establishment are aggregated into the category represented by the principal items of that establishment or plant. This official claims that by using this procedure the value of plastics shipments of two of the leading producers have not been credited to the plastics industry.

presently operating at over 90 percent of capacity. The increase in acetate yarn consumption is therefore anticipated to be supplied chiefly by imports, especially from the United States. The other types of cellulosic fibers now in use in Canada are expected to be entirely supplied by imports, particularly from the United States of improving its trade balance as the ratio in percent of the volume of imports to exports dropped from 438 in 1975 (trade deficit) to 45 in 1979 (trade surplus).

From 1975-77, the average unit value for imports and exports was similar and in the 36 to 40 cents per pound range. In 1978 the average unit value of imports climbed somewhat, reaching 42 cents a pound, while the average unit value of exports dropped to 33 cents a pound. In 1979, the average unit value of imports increased significantly to 50 cents a pound while the average unit value of exports exhibited a more modest gain increasing to 36 cents a pound. By comparison the average unit value of U.S. imports of plastics was higher at 48 cents per pound in 1975, 54 cents per pound in 1976-78, and 60 cents per pound in 1979. U.S. exports of plastics were considerably higher in price than their Canadian counterpart, increasing in average unit value from 40 cents per pound in 1975-76 to 43 cents per pound in 1978 and then jumping to 48 cents per pound in 1979.

Imports

Canadian imports of plastics increased irregularly from 647 million pounds in 1975 to 938 million pounds in 1979, or at an average annual growth-rate of 10 percent (table A-23). Imports of polyethylene (table A-25) accounted for 26-27 percent of the total volume of plastics imports in 1976-77 but in 1979 declined to 16 percent. During the period 1975-79, imports of polystyrene resin (table A-26) were 5-8 percent of total plastics imports. Imports of PVC resins represented a constant 11-12 percent share of the total plastics imports during this period (table A-27). The ratio of the volume of imports of PVC resins to shipments declined steadily from 51 percent in 1975 to 35 percent in 1979 (table A-31).

During the 1975-79 period, the United States supplied between 78 percent in 1975 and 99 percent in 1979 of both the volume and value of imports by Canada of polyethylene resins (table A-32). The United States annually accounted for 96-99 percent of the volume and value of polystrene imports, and 82-89 percent of the annual trade in PVC resins. These three resins annually represent from one-third to one-half of the total volume and one-fourth to one-third of the total value of plastics imports by Canada. During the period 1975-79, the United States annually represented about three-fourths of the volume and in excess of four-fifths of the value of Canadian total plastics imports.

Exports

Exports of plastics increased from 283 million pounds in 1975 to 834 million pounds in 1979 or 31 percent per year (table A-23). The value of exports also increased at an average annual rate of 31 percent during this period or from $102 million to $302 million. The ratio of the volume of exports to the volume of shipments for key resins (table A-28) climbed irregularly from 33 percent to 42 percent in 1979 but reached a peak for the period of 43 percent in 1978. This ratio has been somewhat lower on the value side each year since the statistics shown for the value of shipments covers a greater number of resins than does the data shown for the volume of shipments (table A-28); it increased from 24 percent in 1975 to 31 percent in 1978.

In 1978 and 1979, polyethylene resins accounted for 35 percent and 40 percent, respectively, of the total volume of plastics exports. This represents a significant jump from the 12-16 percent of the total during 1975-77, indicative of Canada's increasing independence in these resins. Polystyrene represented between 1-3 percent of total plastics exports during 1975-79.

In 1979 the 4 leading markets for exports of polyethylene resins by Canada were the United States, Korea, Australia and the Phillipines (table A-33); for comparison, Mexico also is shown. The United States has been the single most important market for these resins during the period 1975-79. In 1979, the United States received 19 percent of the volume and 18 percent of the value while Korea was the second leading market accounting for 9 percent and 10 percent of the volume and value, respectively.

The 1978 Canadian exports of polystyrene to the United States were 10 million pounds, or 45 percent of their 22 million pounds total. 1/ The United States accounted for 57 percent of the value of polystyrene exports from Canada that year or $4 million of a total of $7 million. The United States received 66 percent of the volume, or 68 percent of the value, of Canada's exports of all other plastics in 1978, or 280 million pounds valued at $111 million of a total of 422 million pounds valued at $163 million. These statistics are typical of those published for all years during the period 1975-79, with the United States normally receiving the largest share of Canadian exports of these products.

Consumption

The apparent consumption of key plastics increased from 1.2 billion pounds in 1975 to 2.1 billion pounds in 1979, or at an average annual rate of growth of nearly 14 percent (table A-23). 2/ The value of consumption for all resins increased from $0.6 billion in 1975 to $0.9 billion in 1978 or at an average annual rate in excess of 14 percent. Statistics for 1979 are not available. During 1975-77, apparent consumption annually exceeded the value of shipments by one-third. This figure declined to 27 percent in 1978, the most recent year available. This decline shows the effect of exports growing at a rate of 31 percent per year versus imports at 10 percent per year.

1/ Statistics Canada, Trade of Canada, Exports, Merchandise Trade, 1976-80.

2/ As previously stated, official Canadian statistics show volume data for certain key resins only. According to information in Kunststoffe, op. cit., p. 38, these key resins typically have represented about 70 percent of total consumption until 1978 when this share fell sharpily to about three-fifths. These data are not available for 1979.

The ratio of the value of imports to apparent consumption for all plastics climbed steadily from 43 percent in 1975 to 46 percent in 1978. By comparison, the ratio of the value of imports to consumption for the United States has never reached two percent. The ratio of imports to consumption for polyethylene resins (table A-29) was annually well below that for all resins, not exceeding the 25 percent reached in 1977 and dropping to under 14 percent in 1979. The imports-to-consumption ratio for polystyrene resins (table A-30) was also well below that for all resins not exceeding 27 percent in 1978.

Future

Expansion Plans

Canada's expansion plans are known for the major resins through 1983. However, with its feedstock advantage vis-a-vis other developed nations, there is no reason to doubt that Canada's plastics capacity will contine to increase throughout the 1980's.

Who, what, when, why, where

The following tabulation shows the Canadian name-plate capacity in place by mid 1980 and what has been announced through 1983 for each of the major commodity resins and in the aggregate.

Capacity (1,000 pounds)

Time period	HDPE	LDPE	PP	PS	PVC	Total
Current (mid 1980)---------	564,480	976,815	299,880	343,980	679,140	2,996,595
Additions, by 1983----------	194,040	566,685	15,435	79,380	22,050	887,590
Total by 1983---	758,520	1,543,500	315,315	423,360	701,190	3,884,185

Source: "Canada offers Resins, Machinery, Molds, Markets-and Rivalry," Modern Plastics, June 1980, pp. 108-109.

Of the overall capacity increase of about 30 percent from 1980-1983, LDPE expansion accounts for nearly two-thirds. In nearly every case, the firm increasing its capacity is integrated back to its own feedstocks such as ethylene, propylene. All of the tonnage of the proposed expansion is accounted for by Canadian subsidaries of U. S. or European multinational firms. With but two exceptions, the increased capacity will be accounted for by current producers of the commodity resins. The expansions will lead to a further concentration in the strength of these firms. Most of the new facilities will be built at the site of current plastics operations. One facility will represent a new plastics operation but it is being built at Montreal, a location that now has about 18 percent of the total petrochemical plant capacity in Canada. Sarnia, Ontario accounts for about 48 percent of the total plant capacity of the Canadian petrochemical industry, and Alberta, principally the Edmonton area, accounts for another 28-30 percent. 1/

Canada has ample feedstock for plastics as it is a significant producer of oil and natural gas. The construction of two more world-scale ethylene plants will supply feedstock for derivatives such as ethylene oxide, ethylene glycol, LDPE, styrene and so forth.

Impact on industry

Canada has been forced to build world-scale plastics facilities in order to be economically competitive with the other major producing nations. As stated earlier, the problem with plants of this size in a country with a small population is that the output from one of these plants greatly exceeds domestic needs and it takes local demand 3-5 years to catch up with the new capacity. In most cases domestic demand will only account for about two-thirds of available capacity for about 5 years after the start up of a plant. For example, it is reported that one modern world-scale plant for polyethylene could supply the entire market available to Canadian producers in the 1970's. 2/ Therefore in order to operate in a efficient manner, exports will become essential for the Canadian producers of the leading commodity resins. 3/ By becoming self-sufficient in plastics through the establishment of world-scale plants, Canada should be able to supply much of its own needs for the high value added, labor intensive plastics processing industry. This industry consists of those firms which transform plastics into finished products or parts. There are approximately 1,400 such establishments in Canada, of which 60 percent have annual sales of less than $1 million. Employment was put at 45,000 in 1974 and has since increased at 6 percent per year. 4/ By 1985, employment in the plastics processing industry is forecast to increase by between 15,000 to 30,000 to reach a total of 60,000 to 75,000.

1/ Report of the Consultative Task Force, op. cit., p. 6 of the sector profile section.

2/ Speech by Clifford L. Mort, Dow Chemical of Canada, "Challenges from the North: Canada," at the Chemical Marketing Research Association Annual Meeting, Feb. 6-8, 1980, Wash., D.C.

3/ Through 1980 some 50 percent of Canada's total petrochemicals (not just plastics) production will have come from older and less-than-world-scale plants. Escalating capital costs for new plants have improved the relative economics of these older plants.

4/ In Canada the largest single direct cost (30-60 percent) of manufacture in plastics processing is the cost of the resins. Through 1979, domestic production provided about 70 percent of the resins used. However Canadian fabricators suffer other disadvantages compared to their U.S. counterparts such as scale and specialization. Sector Profile-The Plastics Processing Industry in Canada, a discussion paper prepared by the Federal Department of Industry, Trade and Commerce, June 1978, pp. 1, 2, 3, 5, 7 and 8.

Demand

Canada's per capita consumption of plastics is currently below that of other developed nations which is indicative of a less mature industry. However this is misleading in the sense that much of Canada's plastics needs are furnished through the importation of semimanufactured and finished goods. For example, plastics are being imported into Canadian markets as component parts of consumer goods such as household appliances, automobiles, automotive parts, clothes as well as in other manufactured items which contain a high value of plastics components. 1/ In fact, Canada imports more finished goods than any other nation. It is estimated that in 1978 Canada imported $754 million (or Can $860 million) worth of finished plastics goods. 2/ These imports are calculated to represent about 25 percent of the total estimated Canadian shipments of finished plastics products. This means that there is ample room for import replacement. Therefore, if Canada can back out most of these imported goods its demand for plastics is expected to grow at an average above that of the major producers (i.e., Japan, West Germany and the United States).

Forecast growth

Trade sources 3/ report that the Canadian plastics industry will grow 10-12 percent a year from 1978-1988, as compared to a projected 6-7 percent annual growth rates in the United States 4/ for this period 5/.

There are several reasons for this projected rapid growth rate which are applicable to Canada, the United States and other plastics producing countries. First, plastics often enter markets typically growing at a significantly faster rate than the GNP such as packaging. 6/ Second, there is the additional growth which occurs through the substitution of plastics for natural products such as wood, glass, paper in certain applications. As long as the cost-competitive position of plastics is not affected adversely by a sudden surge in price, the substitution component of growth will remain an important factor.

The consumption of the leading thermoplastics in Canada is shown below for 1978, and is projected for 1980 and 1985. 7/ The average annual growth rate for each resin and the aggregate is also shown for 1978-85.

1/ Report of the Consultative Task Force . . ., op. cit., p. 9.

2/ Speech by David Collenette, op. cit.

3/ Canadian Plastics, November 1978, p. 12.

4/ Hydrocarbon, November 1978, pp. 99-103.

5/ Speech by Thomas H. McGreevey, SRI International, op. cit., in which he forecast that the Mexico demand for the leading plastics would approximate 13 percent a year from 1980-1985 (at Toronto, Ontario, Nov. 15, 1979).

6/ Speech by George B. Hegeman, Arthur D. Little, Inc., Cambridge, Mass., "Petrochemical End Uses in the U.S. Economy-A Forecast for the 1980's," at the Commerical Development Association Meeting in Houston, Texas, Jan. 18, 1979.

7/ Speech by Thomas H. McGreevey, op. cit.

(1,000 pounds and percent)

Time period	HDPE	LDPE	PP	PS	PVC	Total
1978	319,725	617,400	165,375	407,925	352,800	1,863,225
1980	363,825	716,625	209,475	429,975	418,950	2,138,850
1985	617,400	1,014,300	352,800	628,425	661,500	3,274,425
Projected average annual rate of growth 1978-85 (percent)	9.9	7.3	11.4	6.4	9.4	8.4

Source: Thomas H. McGreevey, SRI International, op. cit.

The average annual rate of growth for these plastics in Canada for the period 1980-85 is projected at 9 percent. By comparison the projected average annual rate of growth in the United States for these products is 5 percent for the period 1978-85 and 6 percent for the period 1980-85. 1/ Mexico's projected average annual growth rate 2/ for these resins for the period 1980-85 is as follows: HDPE (15 percent), LDPE (12 percent), polypropylene (12 percent), polystyrene (13 percent), PVC (12 percent), and overall (13 percent).

Reasons for growth

Canada's Gross Domestic Produce reached US $200 billion in 1977 and is projected to increase to US $276 billion (in constant 1977 Canadian dollars) by 1985, for an overall gain in excess of 37 percent, or an average annual increase of 4 percent. 3/ The population of Canada is forecast to increase at 1.1 percent a year from 1976-1990 from 23.0 million to 26.7 million, or by 16 percent overall. These are among the more important factors upon which the above growth is predicated. Another factor contributing to increased demand is the market maturity. As stated above the consumption of these leading resins per capita in Canada is much lower than elsewhere in the developed world because of the high level of imports of plastics products and products which contains plastics as component parts. Import substitution alone should contribute to a higher than developed world average rate of growth.

Relationship to the United States

The per capita consumption of polypropylene in Canada for 1978 was calculated at only 7 pounds per person. 4/ By comparisons, in the United States, this figure for 1978 was calculated to be 12.4 pounds per person.

1/ Modern Plastics, Jan. 1980, various pages and speech by Thomas H. McGreevey, op. cit.

2/ Ibid., Thomas H. McGreevey.

3/ WORLD-regional-CASTS . . . op. cit., Summary-Economic Outlook, pp. A-2-A-8.

4/ Speech by Thomas H. McGreevey, op. cit.

Canada's per capita consumption for the 5 leading commodity resins was calculated at over 79 pounds per person for 1978. For the United States, this figure calculated to about 102 pounds per person. Therefore Canada, with its lower per capita consumption of the leading plastics, is much further away from maturity in its plastics industry than is the United States or the other world leaders such as Japan and Western Europe.

Canada's depreciation policy is far more liberal than that of the United States. Canada allows a firm to receive 150 percent of its capital expenditures on research and development. Canada also allows a firm to write off a manufacturing plant in one year. The capital-intensive U.S. chemical industry contends that the U.S. tax code has kept depreciation allowances unrealistically low. Because of the current level of inflation, write-offs for the U.S. chemical firms have been declining relative to the industry volume of business. The result is that, at the end of the useful life of some piece of capital equipment, the U.S. firm has not recovered enough tax savings through depreciation to make up for the replacement cost of that equipment. Companies that have the biggest capital investment, such as plastics, are harder hit than companies with little investment relative to sales. 1/ The "capital-cost recovery act," 2/ better known as the "10-5-3" bill, 3/ is one method proposed for accelerating the depreciation in the United States of plant and equipment. It is the method favored by the financial executives of the chemical companies to help reverse the trend toward declining U.S. productivity.

Relationship to Mexico

Canada and Mexico are both energy rich. However, for reasons stated earlier, Canada's eastern provinces are net oil importers since there is no west-to-east pipe line. Canada's infrastructure industry including the railway system, port facilities, utilities, and road networks are generally superior to Mexico's and in line with that of the United States. Mexico's population of 66.5 million in 1978 was better able to sustain world class plastics operations without being export dependent than was Canada's 23.5 million in 1978. However, much of Mexico's population is outside its money economy at 49 percent unemployment or underemployment versus Canada's 8.4 percent in 1978. 4/

Trade

Canada's excess plastics capacity will enter world markets in increasing volume by the mid 1980's. The third world will be the initial market but in the next decade Japan, Western Europe and the United States could receive

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1/ "Inflation-It's also Striking Hard at U.S. Corporations," The News American, Aug. 31, 1980, p. 16C.

2/ "Chemical Firms Applaud Move for Faster Write-Offs," Chemical Week, July 9, 1980, pp. 32-33.

3/ This stands for three stipulated write-off periods: 10 years for plant structures, 5 years for equipment and 3 years for autos and light trucks.

4/ Bureau of the Census, Statistical Abstracts on the United States, 1979, p. 902.

increasing competition in home and export markets from plastics manufactured in Canada. Through the 1980's Mexico could be an important market for certain resins such as polypropylene.

Changes in imports and exports

Canada, with its relatively small population of 23.5 million in 1978 which is expected to rise to 25.7 million in 1985, 1/ will become self sufficient in the large commodity resins as it installs more world class plastics facilities. These facilities are necessary in order to be economically competitive with the United States, Japan and Western Europe in the Canadian and export markets. Therefore, the United States could lose Canada as its leading plastics market over the next five years. Canada may continue, however, to receive special grades of the volume resins as well as those special, high performance resins for which it has a limited market which could not support Canadian production facilities.

Likely new trading partners

With world-scale plastics plants on-stream, Canada will have to look to the export market if it wants to make significant increases in capacity. With ample feedstocks available in Canada, it is clear the Canadian plastics industry will consider such moves. The United States, Western Europe and Japan could become eventual targets for Canadian exports but not unitl the 1990's. At present these countries are net plastics exporters with excess capacity. The markets for Canadian plastics exports in the 1980's will be found in the countries making up the rest of the world. Between 1980 and 1985, Central America (including Mexico), South America, Southeast Asia and even Africa and the Middle East will be areas of opportunity for Canada's plastics exports. 2/

Canada's resins are now price competitive with those of the United States and have a price advantage over the resins of Japan and Western Europe which are both highly dependent on higher priced imports of oil and natural gas. Therefore, Canada should be able to move into export markets served by Japan and Western Europe, especially the large volume resin markets.

Impact on producers, consumers and new uses

It is doubtful if increasing resin prices will make them less competitive with their natural competitors, such as glass, paper, and wood. For example, commodity plastics are much lighter in weight and have lower shipping costs per unit than do traditional competitors such as glass. 3/ Also, plastics, in general, require less energy input during product fabrication than do most

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1/ Speech by Thomas H. McGreevey, *op. cit.*
2/ *Ibid.*
3/ Speech by Geoffrey Snelling, E.I. du Pont de Nemours, Wilimington, Del., "Energy and Cost Efficiency of Plastics," at the Fourth Annual Conference on Contingency for Plastics, New York, N.Y., Sept. 20-21, 1978.

competitive natural materials. For example a 28 ounce frozen food package of LDPE requires 100 units of total energy as compared to a paper board container which requires 460. 1/ Therefore, although fabricators will be paying more for plastics in the years to comes, plastics will still compete with natural products on a cost-effectiveness basis. Also plastics do not operate in a vacuum; the costs of competitive materials will rise proportinately to those of plastics. 2/ This is especially true for nations such as Canada which have an abundant supply of raw material for plastics. There are some end markets which are so price sensitive (e.g., straws) that a slight change in the price of plastics could turn the market back to its natural competitor (e.g., paper). However plastics usually have certain property advantages (e.g., can be extruded at high rates of speed, good insulation, mositure resistance) that overcome incremental price differences.

1/ Ibid.

2/ Speech by F. J. Corcoran, DuPont Canada, Inc., "High Density Polyethylene in Canada some Planning Considerations through 1984," at First Annual Canadian Outlook Conference on Resin Supply/Demand, Toronto, Ontario, Nov. 15, 1979. He stated that aluminum would increase from 7.08 cents per cubic inch in 1979 to 8.20 cents per cubic inch in 1982 (16 percent overall); while during that period HDPE would climb from 1.23 cents per cubic inch to 1.37 cents per cubic inch (11 percent overall).

OTHER PETROCHEMICAL DERIVATIVES

Present Situation

Description and Uses

The major petrochemicals produced in Canada other than those already discussed are included in the following categories: dyes, organic pigments, carbon black, plasticizers, rubber-processing chemicals, explosives, and to a smaller degree medicinal chemicals, flavor and perfume chemicals, and surface-active agents. Not all of the items in each of these categories is a petrochemical since some may be based on natural products.

Carbon black is a product which is derived from natural gas. For every thousand cubic feet of methane (CH_4), 33 pounds of carbon black can be produced; an equivalent volume of ethane (C_2H_6) would produce double the amount of carbon black. Natural gas normally contains between 10 and 20 times as much methane as it does ethane.

The main use for the carbon black produced in Canada is in rubber products. It is used as a filler pigment, adding both volume and color to items such as pneumatic tires and tubes for tires. Other applications include its use as a printing ink, in protective coatings, phonograph records (as a filler pigment), colored paper, carbon paper, concrete, plastics, and synthetic fibers.

Surface-active agents are organic chemicals which reduce the surface tension of water or other solvents. They are routinely incorporated into packaged soaps and synthetic detergents, both for household and industrial uses. Other industrial functions include textile processing, an aid in ore flotation, and petroleum processing. Consumer goods in which surface-active agents are used include cosmetics, foods, paints, and pharmaceuticals.

Organic dyestuffs and organic pigments, other than carbon black, are derived from benzenoid chemicals and cyclic intermediates, both petrochemical sources. The Canadian textile industry uses much of the Canadian dyestuff output to dye fibers and fabrics; the remainder is used for coloring paper, for dyeing leather, and in the production of organic pigments.

Organic pigments, which differ from dyes in that they are insoluble, are used when the situation requires that the color remain insoluble. One of the largest Canadian consumers of organic pigments is the Canadian printing ink industry. Other large Canadian industrial users include the paint and coatings industry, the color plastics industry, and the textile industry.

Organic pigments are produced totally from synthetic organic dyestuffs. Although natural dyestuffs could be used in their manufacture, economic reasons have forced the use of almost 100 percent synthetic dyestuffs. Of the two final forms which the pigments may take, color toners do not require a substrate. Color lakes require an insoluble organic compound onto which the dyes are precipitated. Toners make up more than 95 percent of the global market for pigments and are marketed either full strength or diluted by the addition of a solid diluent.

Glyceryl nitrate (nitroglycerin) and 2-4-6 trinitrotoluene (TNT) comprise the majority share of petrochemical explosives. Nitroglycerin, a component of dynamite, is used by industry as a tunnel explosive, mining explosive, and as an aid in the metal processing industry. Military uses for these explosives include producing fragmentation, air blast, underwater shock, armor penetration, and demolition. Nitroglycerin and TNT are favored for these applications because of their "noninitiating" nature. This means that they are not likely to self-detonate by impact, friction, or the brief administering of heat.

In addition to its use in explosives, nitroglycerin has been used as a pharmaceutical for 90 years. It belongs to a family of drugs known as vasodilators. It is used specifically to relieve pain associated with angina pectoris.

Other petrochemical categories included in this section are rubber-processing chemicals, plasticizers, and flavor and perfume chemicals. Rubber-processing chemicals are added to both natural and synthetic rubber in order to impart specific qualities needed in certain finished products, and also to facilitate handling of the material during production. The range of compounds includes accelerators, activators, vulcanizing agents (involved in production procedures), antioxidants, antizonants, and stabilizers (to prevent product deterioration).

Plasticizers which are of petrochemical origin include di(2-ethyl hexyl) phthalate (generally used in polyvinyl chloride) and all of the other phthalic acid esters. Although replacements for the phthalates are often advertised, the industry still prefers the dioctyl phthalates, of which di(2-ethyl hexyl)) phthalate is the perferred choice.

Flavor and perfume chemicals of petrochemical origin include synthetic organics such as saccharin (flavor) and several artificial musks (perfumes). Saccharin, first synthesized in the United States over a century ago, is an intensely sweet, white crystal. The commercial form of saccharin is the sodium salt, which is used as a sugar substitute in diet soft drinks and as a replacement for table sugar.

Musk xylol, musk ketone, and musk ambrette are three examples of artificial musks used by perfumers as substitutes for the naturally occurring product. Each of these synthetic alternates possesses certain individual properties which a perfumer selectively chooses to put into a fragrance. Musk xylol is mostly used in soaps; musk ambrette is used not only in perfumes but additionally in items such as toothpaste where it imparts a flavor in addition to its odoriferous properties. Musk ketone, used in fragrances as a fixative, most closely resembles the odor of the natural product.

Customs Treatment

Tariff

Canada has long been a member of the General Agreements on Tariffs and Trade (GATT) and has been strongly supportive of its policies. Although there have been powerful nationalist pressures and increasing numbers of national development strategies, tariffs have been reduced to levels within the 5 to 10 percent range for commodities entering from those countries with most-favored-nation status. There are high duties only on import items which threaten Canadian domestic industry with intense competition.

Within the past 5 years, petrochemical products have had their tariffs significantly reduced (see table A-34). Synthetic organic dyestuffs previously entered Canada at a range of dutiable rates between 10 and 15 percent. These rates have been reduced to a range between no duty at all and 14.4 percent. Organic pigments have also been negotiated to a rate of 14.4 percent as of January 1, 1981. Duties on organic surface-active agents have also been reduced to 14.7 percent. Flavor and perfume chemicals enter classified in several different categories at rates ranging from free to 7.5 percent. The higher rate will be reduced as of January 1, 1981 to 6.2 percent.

Non-tariff barriers

For general information on non-tariff barriers, see the Olefins section of this report.

Structure of the Industry

The Canadian petrochemical industry dealing with other petrochemical derivatives is structured similarly to the U.S. industry. Outside the sector of the Canadian petrochemical industry owned by the CDC, the degree of foreign involvement is much higher than the degree of foreign involvement in the United States. In fact, the largest foreign national investor in the Canadian petrochemical industry is the United States. Among the largest of Canadian petrochemical producers are the subsidiaries of the largest major U.S. chemical companies. These companies are large, horizontally integrated firms which produce goods for both consumer and industrial consumption. As in the U.S., companies once known as manufacturers of a specific product line have often diversified into new fields. This allows for the companies' survival in the event of a shortage in certain feedstock materials or a declining market for their chemical products for whatever reason.

Technology

Canada benefits a great deal from the import of foreign technology, the results of much of the development are products tailored mainly for Canadian consumption and unsuitable for export. The dependence on foreign original technology leaves the Canadian petrochemical manufacturers vulnerable to both the parent company and the parent firm's domestic Government.

Specifically, surface-active agents, flavors, and perfumes are used in final products which change their compositions fairly often . This is due to changes in consumer demand and the overall competitiveness within the two industries. Sales of cosmetics and toiletry products, because they are consumer products, are controlled by the buying habits of the general public much more so than industrial products such as pigments, dyes, rubber-processing chemicals, and plasticizers. Innovations are continuously being made in both the form of old products as well as frequent developments of new products.

Innovations in form include new items such as liquid skin cleaners which work without soap, caustics, abrasives, solvents, and a new suntan lotion formulated for the first time without mineral oil. Most new products which are petrochemical in nature are synthetic reproductions of natural products. Synthetics are generally employed when the natural product is either unobtainable or costly.

Examples are synthetic musk and synthetic menthol. Musk, one of the most sought after, and rarest of natural perfumes, has several synthetic forms, each chemically similar to and possessing the aromatic qualities of the natural product. These synthetics are selectively used in its place depending upon which aromatic tonal quality is desired.

Menthol, although plentiful in supply in its natural state, has been produced synthetically for use as a flavoring in candy, medicinals, and most importantly tobacco products.

Government Policies and Involvement

For general information concerning Government Policies and Involvement, see the section on Olefins.

Government-industry relationship

The Canadian Government has policies which encourage research and development in the field of other petrochemicalss. The income tax laws allow as tax deductible all expenditures on scientific research and development into other petrochemical. In addition, any of the scientific research expenditure can be deferred to later years instead of being deducted immediately.

Pollution control regulations set up by the Canadian Government are roughly equivalent to those set up by the U.S. Government for other petrochemicals. In addition to the major environmental problems caused by Canadian manufacturing plants, additional problems stem from pollution and environmental disruption from the U.S.

Production

Production gains in 1979 were modest for the Canadian petrochemical industry, though the petrochemical industry fared better than Canadian industry as a whole. Because of inflation, the dollar value of shipments has increased at a faster rate than actual production. The total value of shipments for 1979 was predicted to reach C$9.40 billion (Canadian dollars), an increase of approximately 18 percent from the 1978 value of C$7.96 billion.

Of all the petrochemical items discussed in this section, the overwhelming majority of Canadian production is fueled with imported feedstock materials.

At the present time, the Canadian petrochemical industries producing synthetic detergents, plasticizers, rubber-processing chemicals, and carbon black, imports the major part of the precursor materials needed because of economic reasons. Canada has only recently begun construction of pipelines which will bring domestic feedstock materials from Western Canada to Canada's industrialized eastern areas where the majority of the facilities for production of secondary petrochemicals are located.

Factory shipment values of certain individual items described in this section have increased much faster than the average for all petrochemicals. Organic pigments and dry colors have increased their value of shipments by 31 percent between 1978 and 1979. Other industrial organic chemicals (including plasticizers and rubber-processing chemicals) have jumped in value of shipments by 43 percent between 1978 and 1979. The growth in industrial organic chemicals has occurred despite an 18.9 percent increase in prices. 1/

One item in which production is continuing to rise is explosives. With increasing oil pipeline construction, new coal mining operations, and more oilsand mining, the demand for explosives is continually increasing. Slurry explosives are favored now for the work neccesary for mining and tunneling operations. 2/ These explosives, a mixture of ammonium nitrate and fuel oil, have begun replacing other explosives, especially those based on nitroglycerin. Although the demand for and production of nitroglycerin has decreased, new facilities for the production of these slurry explosives have come on stream.

The production of synthetic detergents has been increasing gradually at an average annual rate of approximately 4 percent. There was a slight drop in value of shipments for all soaps and detergents in 1975, but since then the Canadian surface-active agent industry has maintained a slow but steady growth rate. Presently, certain synthetic detergent producers are concerned about continued growth in the future. Canadian detergent manufacturers have been especially hard hit by feedstock price increases as the majority of the surface-active agents used in the preparation of the detergents are imported from the United States (see table A-35). The large Canadian producers will soon be paying 41.5 cents per pound in U.S. dollars for detergent alkylate, the base petrochemical for many of the synthetic detergents formulated in Canada, a 269 percent increase over the 1973 price of 11.25 cents per pound. 3/ Total price for the active ingredient will run to over 50 cents per pound when transportation costs from the Texas manufacturing plant to the Ontario formulator are included. Unless alternate ingredients are used, the 1980 annual cost for detergent alkylate may surpass US$30 million. Reformulation is highly unlikely because of the competitiveness of the industry and the regulations concerning the effects of new ingredients on health and environment. 4/

There is also Canadian production of organic pigments (see table A-36) although all of the feedstock materials used in the production are imported. Canadian manufacturers of carbon black (see table A-37) and plasticizers (see

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1/ "Market Data," Canadian Chemical Processing, Sept. 5, 1979, pp. 41-48.
2/ "Market Data," Canadian Chemical Processing, Aug. 1977, p. 30.
3/ "Soapers Boxed-in by Price Rises," Canadian Chemical Processing, Oct. 10, 1979, pp.37-38.
4/ "Soapers Boxed-in by Price Rises," Canadian Chemical Processing, Oct. 10, 1979, pp.37-38.

table A-38) presently use domestic feedstocks from the Western Canadian reserves and supplement these feedstocks when needed with imported source materials.

These and other Canadian petrochemical manufacturers, somewhat dependent upon the United States as a market for their products, have seen decreases in their production demand corresponding with recessions and other economic crises in the United States. These decreases is most commonly experienced by producers of consumer rather than industrial products.

Trade

The major international trade market for Canada is presently the United States. During the Tokyo Round of Multilateral Trade Negotiations, bilateral talks between the U.S. and Canada intensified principally in an energy related context. There have been no formal agreements yet announced, although it is anticipated that there should be some mutual concessions in the near future.

Overall, Canada's trade picture in all chemicals shows increases in both imports and exports. Chemical exports increased almost 41 percent between 1978 ($2,357 million) and 1979 ($3,315 million) after a 36 percent increase the year before. Of the exports in 1979, over 71 percent went to the U.S. ($2,362 million). In 1978, 77 percent of Canada's chemical exports went to the U.S. ($1,805 million). Canadian chemical imports in 1979 ($3,213 million) showed an increase of 23 percent from 1978's value ($2,621 million). The 1978 export value included a 32 percent increase from the 1977 value ($1,992 million). Of the total Canadian chemical imports in 1979, 62 percent were supplied by the U.S. ($1,991 million). In the preceeding year, the percentage of Canadian imports supplied by the U.S. chemical industry was 66 percent ($1,739 million).

Canada's overall trade deficit in all chemicals reverted to a surplus in 1979, switching from a deficit of $264 million in 1978 to a surplus of $102 million in 1979.

Imports

The overall 23-percent increase in chemical imports was led by large increases in imports of organic petrochemical products Canadian imports of organic pigments, color lakes and toners (see table A-36), showed an increase in quantity of 13.9 percent between 1978 and 1979. Other import data for organic pigments both by quantity and value can be seen in the following tabulation: 1/

1/ Extracted from table A-36.

Year	Quantity	Percentage change from previous year	Value	Percentage change from previous year
	Million pounds		Million U.S. dollars	
1975	-	-	-	-
1976	23.8	-	28.6	-
1977	20.6	-13.4	30.1	5.2
1978	24.5	18.9	43.7	45.2
1979	27.9	13.9	60.5	38.4

During the 5 year period from 1975 to 1979, imports of organic pigments have increased in quantity by 88 percent and in value by 106 percent. Canadian imports of organic pigments from the United States have increased in quantity by approximately 64 percent despite considerable variation as can be seen in the following tabulation: 1/

Year	Quantity	Value
	1,000 pounds	1,000 U.S. dollars
1975	2,624	5,007
1976	7,096	7,788
1977	1,873	5,199
1978	3,666	9,619
1979	4,294	11,871

Since 1977, Canadian imports of organic pigments from the United States have increased steadily, comprising between 15 and 25 percent of the total organic pigment imports.

Selected organic dye imports grew modestly between 1978 and 1979, increasing in quantity from 22 million pounds in 1978 to 23 million pounds in 1979 (see table A-39), or by approximately 5 percent. In terms of value, the increase in dye imports between 1978 and 1979 was 82 percent (see table A-39) an increase from a value of Can45 million in 1978 to Can$82 in 1979.

Imports of organic dyestuffs from the U.S. increased between 1975 and 1979 as shown in the following tabulation: 2/

1/ Extracted from table A-36.
2/ U.S. Department of Commerce, FT 410, U.S. Exports, 1975-1979.

Year	Quantity	Value
	1,000 pounds	1,000 U.S. dollars
1975 1/	10,478	13,896
1976 1/	11,695	16,540
1977 1/	10,741	16,025
1978	11,974	20,113
1979	12,544	22,472

1/ Data for 1975, 1976, and 1977 include statistics for natural alizarin in addition to the organic dyes.

The overall growth of Canadian imports of organic dyestuffs from the U.S. has been fairly steady. The rate of growth between 1975 and 1979 was 19.8 percent in terms of quantity and 61.7 percent in terms of value.

Canada imports a great deal of surface-active agents to supply the domestic manufacturers of synthetic detergents. Over the 5-year period from 1975 to 1979, imports of selected surface-active agents grew slowly (see table A-35), increasing from 53.8 million pounds in 1975 to 64.6 million pounds in 1979. Corresponding increases in the value of imports ranged from U.S. $22.1 million in 1975 to $34.9 million in 1979 (see table A-35).

Canadian imports of surface-active agents from the U.S. have decreased from 64.4 million pounds in 1975 to 55.7 million pounds in 1979 as shown in the following tabulation: 1/

Year	Quantity	Value	Unit value
	1,000 pounds	1,000 U.S. dollars	Cents per pound
1975	64,486	9,930	15.4
1976	59,177	17,165	29.0
1977	56,700	16,794	29.6
1978	60,308	9,016	14.9
1979	55,709	9,891	17.8

The 8.2-percent decrease in quantity of imports of surface-active agents, along with the considerable variation in the unit price values of these imports, indicates a change in the product mix being used by the Canadian synthetic detergent manufacturers, rather than an actual decrease in surfactant usage.

Canadian demand for industrial organic chemicals has been growing over the past five year period. In response to this demand, imports have also been

1/ U.S. Department of Commerce, FT 410, U.S. Exports, 1975-1979.

increasing, particularly imports of plasticizers (see table a-38) and rubber-processing chemicals. The proximity of the United States has allowed the United States to become Canada's major supplier of these materials. Canadian plasticizer imports from the United States have been increasing steadily since 1975 as can be seen in the following tabulation: 1/

Year	Quantity	Value	Unit value
	1,000 pounds	1,000 U.S. dollars	Cents per pound
1975	21,191	7,278	34.3
1976	26,950	8,918	33.1
1977	27,364	9,941	36.3
1978	31,040	11,707	37.7
1979	28,751	12,985	45.2

Canada has also continued to import rubber-processing chemicals for its synthetic rubber manufacturing industry. Import statistics for rubber-processing chemicals from the United States can be seen in the following tabulation: 2/

Year	Quantity	Value	Unit value
	1,000 pounds	1,000 U.S. dollars	U.S. dollars per pound
1975	12,470	8,677	.70
1976	11,299	10,389	.92
1977	1/	9,826	
1978	11,527	11,600	1.01
1979	15,663	17,028	1.09

1/ Not available.

These data show an increase of 25.6 percent in Canadian imports in terms of quantity of U.S. manufactured materials. The corresponding increase in terms of value of Canadian imports of U.S. produced rubber-processing chemicals was approximately 56 percent.

Additionally, Canada provides the largest foreign market for U.S. produced explosives. Dynamites and other high explosives, including nitroglycerin and TNT, were imported primarily by Canadian mining, quarrying, and oil drilling

1/ Unit value varies according to the product mixture in each year's data.
2/ U.S. Department of Commerce, FT 410, U.S. Exports, 1975-1979.

interests. Statistics on Canadian imports of U.S.-produced petrochemical explosives can be seen in the following tabulation: 1/

Year	Quantity	Value	Unit value
	1,000 pounds	1,000 U.S. dollars	Cents per pound
1975 1/	4,071	1,743	42.8
1976 1/	12,707	4,100	32.3
1977 1/	4,696	2,525	53.8
1978 2/	9,708	3,542	36.5
1979 3/	8,952	4,088	45.7

1/ Data based on Schedule B Nos. 571.1210, 571.1220.
2/ Data based on Schedule E Nos. 572.1220, 572.1260, 572.1260.
3/ Data based on Schedule B Nos. 485.100, 485.1500, 485.4500.

The reason for the variation in both volume of imports and unit value lies in the stockpiling of goods by industrial users when available at lower prices.

Exports

Exports of representative dyestuffs and pigments (see tables A-39 and A-36) increased to a value of $11.3 million in 1979, an increase of 44 percent over 1978's value of $7.8 million. Other export values (see table A-40) include $1.7 million for representative flavors, an increase of 17 percent over the 1978 value of $1.5 million.

Canadian petrochemical exports to the United States include a significant amount of plasticizers (1.8 million pounds in 1978 and 3.8 million pounds in 1979) and explosives (21.3 million pounds in 1979); both items are traded liberally across the border. The volume of Canadian exports of explosives to the United States can be seen in the following tabulation: 2/

Year	Quantity	Value	Unit value
	1,000 pounds	1,000 U.S. dollars	Cents per pound
1975	8,227	4,991	60.7
1976	4,091	1,773	43.3
1977	12,802	7,927	61.9
1978	22,177	15,414	69.5
1979	21,315	25,639	120.3

1/ U.S. Department of Commerce, FT 410, U.S. Exports, 1975-1979.
2/ U.S. Department of Commerce, IM 146, U.S. Imports for Consumption, 1975-1979.

The variation seen here is similar to the variation seen in Canadian imports of explosive materials. The industrial users favor the building up of inventories of explosives when the items are readily available at prices which the users view as reasonable.

Consumption

The chemical industry in Canada in 1979 exported nearly 35 percent of its total production. It's domestic consumption of $9,400 million in 1979 was the highest value in the Canadian chemical industry's history. This value reflects a 14.3 percent increase in consumption from 1978 when the value was approximately $8,224 million.

It is difficult to obtain consumption figures for individual chemicals and chemical categories outside of the major breakouts mentioned elsewhere. The Canadian statistical system does not provide this sort of data. In most cases, though, apparent consumption of the petrochemicals described in this section consists mainly of imports as major portions of the U.S. petrochemical industry do not yet exist in Canada. In particular, Canada has insignificant or no production (only processing) of surface-active agents, and organic dyestuffs. There is additionally very little production of flavors, perfumes, or rubber-processing chemicals.

The most recent documented statistics for petrochemical end-product consumption is for 1977. 1/ In that year, production of petrochemical end-products reached a value of $1,189 million. Domestic sales accounted for 74 percent of the production ($875 million) while exports worth $314 million accounted for the rest. With petrochemical imports in 1977 of $779 million, the total Canadian petrochemical end-product consumption was valued at $1,654 million.

Future

Expansion Plans

In a June 1970 Canadian Government publication entitled Foreign Policy for Canadians, 2/ several Canadian foreign policy options were listed. The option favored by the Government consisted of a "comprehensive long-term strategy to develop and strengthen the Canadian economy . . . and reduce the present Canadian vulnerability to the United States". 2/ To that end, the present Canadian Government is issuing plans which would assure at least a 50-percent Canadian ownership of the largely American-controlled oil and gas industry by 1990. 3/ This industry produces the feedstock materials for Canada's secondary petrochemical industry, which could one day be producing all industrial organic chemicals, including pigments, dyes, and surface-active agents, as well as flavor and perfume chemicals.

1/ Chemistry and Industry, Feb. 17, 1979, pp. 106-110.
2/ Canada Embassy, Canada Report, Washington, D.C., Mar. 22, 1974, p. 3.
3/ "Trudeau To Cut U.S. Share in Oil Industry," The Washington Post, Oct. 26, 1980, p. A-1.

Who, what, when, why, where

Expansion now taking place and planned for the next decade in Canada is almost entirely in the area of primary petrochemicals and petrochemical finished products. The presently announced expansions should lead to future expansions of the petrochemical industry to include the manufacturing of organic dyestuffs, organic pigments, industrial organic chemicals, and surface-active agents. At the present time, Canadian manufacturers of consumer items such as synthetic detergents rely upon U.S. production of the surface-active agents for their feedstocks. At some future time, with increases in capacity for primary petrochemicals and petrochemical intermediates, Canadian manufacturers may become less reliant upon foreign sources for intermediates and feedstocks.

Impact on industy

The positive Canadian chemical balance of trade shouldcontinue increasing as more and more petrochemical production is introduced. As plants are built and brought on stream in Western Canada, where the natural gas and petroleum reserves (feedstocks) are located, exports are expected to increase. In addition to the increased development in Western Canada, Canadian petrochemical manufacturers can look to expansion of production in product areas such as surface-active agents, flavors and perfume chemicals. The Canadian industry involved in the manufacture of industrial organics, pigments, and dyes can expand their export markets without expansions in production facilities, as the Canadian Government is looking forward to increased trade with industrialized nations other than the United States such as Japan and the European Community.

Demand

Forecast growth

There is very little demand growth expected involving petrochemicals discussed in this section in the 1980's. Because of the over-whelming percentage of non-domestic ownership of the petrochemical industry in Canada, Canadian production tends to produce goods to supply Canada's market and fill in deficits in the markets of other nations where ownership is based. The demand force which increased Canadian production will likely satisfy will be a global demand.

Reasons for growth

The most important stimulant for growth in petrochemical production in Canada is an increasing nationalistic feeling. The Canadian Government is encouraging growth in the petrochemical industry for the purpose of increasing exports, expanding Canadian international trading possibilities, and decreasing any Canadian reliance on foreign production.

It is important to note that while output in petrochemicals has increased greatly, the increase has been related to growth in the labor force rather than increased productivity. The Canadian economy has experienced very little real growth. The average annual output per person has only increased by 2.5 percent since World War II, among the lowest of any industrialized nation. In 1978, there was zero growth in labor productivity.

Relationship to U.S

Canadian demand for finished chemical products still is far ahead of production capacity. Imports from the U.S. of organic pigments, dyestuffs, rubber-processing chemicals, plasticizers, and explosives are increasing annually while surfactant and flavor chemical imports have remained fairly stable since 1975. In the future as world-scale plants come on stream in Canada, an increasing share of Canadian demand for petrochemicals will be supplied by local production.

Canadian sources feel that their potential for other petrochemical derivatives production can be met only with good access to export markets. The U.S. market continues to be protected from Canadian exports by both tariff and non-tariff barriers. 1/ The president of a major Canadian petrochemical concern feels that, through bilateral negotiations in the future, tariffs on petrochemicals may be reduced significantly and equitably. The United States would probably lose a minimal amount of its growth potential in production of other petrochemicals derivatives to Canadian industry; but Canadian sources believe a stronger Canadian industry would be very beneficial to the United States. 1/

Relationship to Mexico

Mexico, having very little native petrochemical technology of its own, is looked upon as a future trading partner. Canada feels she can export her advanced technology to Mexico for some of the raw materials Mexico still lacks to become a more complete producer and trader in petrochemicals and petrochemical end-products.

Trade

Changes in imports and exports

Although there are anticipated increases in both imports and exports, the Canadian balance of trade in petrochemicals is expected to remain positive for the near future. The year 1979 was the first positive balance of trade year for Canadian petrochemicals. No export figures are available which correspond to industry figures for imports in petrochemical-dependent industries such as organic dyes, pigments, rubber-processing chemicals, plasticizers, or surface-active agents. Import trends indicate increasing import levels in all of

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1/ "Chemical Cooperation in Resources of the North American Continent," Chemical & Engineering News, Sept. 22, pp.34-39.

these categories. These products, used in production and in formulating final products, are then exported in forms other than which they had been imported. In these secondary petrochemicals, there will continue to be a negative trade balance, with increasing imports and minimal exports.

Likely new trading partners

Canada is looking for industrialized nations with which to trade in order to more clearly define her own national identity. In particular, Japan and several EC nations (e.g., Federal Republic of Germany and France) have been viewed as potential markets into which to spread Canada's wealth of products.

Impacts on producers, consumers, and new uses

Canadian inflation has exceeded that felt by the U.S. economy throughout the 1970's. If Canada is able to subjugate the United States to a lesser status in terms of an export market, Canadians feel their economy could stabilize by the middle of the next decade. By placing their products into new inventive hands, new uses for older products may be realized. The Canadian Government is attempting to exert influence to encourage new trade, enabling the Canadian petrochemical industry to a domestically owned to a greater degree. The Canadian Development Corporation is ready to invest Government funds along with private funds in order to further domestic industry, especially that which concerns Canadian petrochemicals.

Statistical Tables

Table A-1--Olefins: Canadian rate of duty, by tariff number

Item No.	Description	Rate of duty		
		Base Rate	M.F.N. Rate	M.T.N. Concession Rate
92901-3	Butadiene	15% ad val.	Free	Free
92901-5	Butylenes (Butenes)	15% ad val.	Free	Free
92901-9	Ethylene	15% ad val.	Free	Free
92901-13	Propylene	15% ad val.	Free	Free
92901-1	Other (Isoprene, Tetrapropylene)	15% ad val.	14.3% ad val.	9.2% ad val.

Source: Arthur L. Brunette Ltd., McGoldrick's Handbook of the Canadian Customs Tariff and Excise Duties 1980-81, Montreal, Canada, 1980.

Table A-2-Ethylene: Canadian production, imports, exports, and apparent consumption, 1975-79

Year	Production	Imports	Exports	Apparent consumption
	Quantity (1,000 pounds)			
1975	943,800	39,600	1/	983,400
1976	1,119,800	63,800	1/	1,183,600
1977	1,247,400	118,800	11,000	1,355,200
1978	1,817,200	11,000	4,400	1,823,800

1/ Canadian exports of ethylene in 1975 and 1976 were negligible.

Source: Ministry of Industry, Trade and Commerce, Statistics Canada, Ottawa, Canada, 1975-1978.

Table A-3-Propylene: Canadian production, imports, exports, and apparent consumption, 1975-79

Year	Production	Imports	Exports	Apparent consumption
	Quantity (1,000 pounds)			
1975	404,800	1/	88,000	316,800
1976	536,800	1/	118,800	418,000
1977	594,000	1/	121,000	473,000
1978	915,200	4,400	325,600	584,000

1/ Canadian imports of ethylene were negligible.

Source: Ministry of Industry, Trade and Commerce, Statistics Canada, Ottawa, Canada, 1975-1978.

Table A-4--Primary Aromatic Hydrocarbons (Aromatics), Canadian Tariff Concessions: Canadian rate of duty, by tariff number

Item No.	Description	Rate of duty		
		Base Rate	M.F.N. Rate	M.T.N. Concession Rate
92901-1	Naphthalene	15% ad val.		9.2% ad val.
92901-2	Benzene	15% ad val.		Free
92901-15	Toluene	15% ad val.		Free
92901-15	Xylenes 1/	15% ad val.		Free

1/ P-xylene is included in "Xylenes" in the Canadian tariff schedules.

Source: Arthur L. Brunette Ltd., McGoldrick's Handbook of the Canadian Customs Tariff and Excise Duties 1980-81, Montreal Canada, 1980.

Table A-6-Miscellaneous acyclic organic chemicals: Canadian imports, by functional groups, 1975-79

Item and year	Quantity	Value	Unit value
	1,000 pounds	1,000 dollars	Dollars per pound
Total:			
1975	562,399	184,177	0.33
1976	600,761	203,036	.34
1977	587,358	221,405	.38
1978	740,181	280,525	.38
1979	814,190	363,650	.45
Nitrogenous compounds:			
1975	105,461	48,871	.46
1976	111,361	48,235	.43
1977	117,827	59,497	.50
1978	155,220	90,554	.58
1979	165,762	107,540	.65
Acids and anhydrides:			
1975	61,396	36,200	.59
1976	73,636	42,274	.57
1977	83,096	34,523	.42
1978	86,369	42,446	.49
1979	94,153	56,527	.60
Aldehydes:			
1975	39,885	4,526	.11
1976	46,446	5,586	.12
1977	43,633	5,971	.14
1978	46,517	8,242	.18
1979	43,687	9,666	.22
Ketones:			
1975	13,562	3,755	.28
1976	10,185	3,471	.34
1977	16,061	5,153	.33
1978	18,142	7,826	.43
1979	24,536	12,648	.52
Monohydric alcohols:			
1975	71,475	7,658	0.11
1976	46,583	7,570	.16
1977	51,496	9,969	.19
1978	48,356	9,078	.19
1979	18,142	7,810	.43
Polyhydric alcohols and derivatives:			
1975	82,943	17,382	.21
1976	51,262	11,378	.22
1977	36,464	9,986	.27
1978	31,359	8,450	.27
1979	35,038	11,924	.34

Table A-5--Selected miscellaneous acyclic organic chemicals: Canadian rates of duty, by chemicals

(Percent ad valorem)

Tariff item number	Description	Base rate of duty	Concession rate of duty
92927-4	Acrylonitrile	15%	6.3%
92927-1 (pt)	Other nitriles	15%	Free-12.5%
92927-2 (pt)			
92923-6	Ethanolamines	15%	11.5%
92922-1	Alkylamines	15%	12.5%
92914-1 (pt)	Acetic acid	15%	12.5%
92914-1 (pt)	Acetic anhydride	15%	12.5%
92911-3	Formaldehyde	15%	12.5%
92911-5	Formaldehyde (containing not more than 15% alcohol)	10%	8.5%
92913-5 (pt)	Acetone	15%	10%
92913-5 (pt)	Methyl ethyl ketone	15%	10%
92913-1 (pt)	Methyl isobutyl ketone	15%	9.2%
92904-1 (pt)	Methanol	15%	12.5%
92904-1 (pt)	Ethanol	15%	12.5%
92904-1 (pt)	Isopropanol	15%	12.5%
92904-7	Butanol: sec-butanol for use in manufacture of methyl ethyl ketone	15%	Free
92904-9 (pt)	n-Butanol	15%	10%
92904-1 (pt)	Ethylene glycol	15%	12.5%
92904-10	Propylene glycol	15%	11.5%
92914-1 (pt)	Acetate esters	15%	12.5%
92914-3			
92914-4			
92914-7			
92914-1 (pt)	Acrylate esters	15%	12.5%
92914-9			
92909-3	Ethylene oxide	15%	9.2%
92909-1 (pt)	Propylene oxide	15%	12.5%
92902-1	Halogenated hydrocarbons	15%	9.2-12.5%
92902-3			
92902-5			
92902-6			
92931-1 (pt)	Organo-sulfur compounds	15%	12.5%
92934-1 (pt)	Organo-silicon compounds	12.5%-15%	10-12.5%
93901-43			
93814-3	Tetraethyl lead and tetramethyl lead anti-knock preparations	10%	8.5%

Source: Arthur L. Brunette Ltd., McGoldrick's Handbook of the Canadian Customs Tariff and Excise Duties 1980-81, Montreal, Canada, 1980.

Table A-6 --Miscellaneous acyclic organic chemicals: Canadian imports, by functional groups, 1975-79--Continued

Item and year	Quantity	Value	Unit value
	1,000 pounds	1,000 dollars	Dollars per pound
Esters:			
1975	55,183	27,619	.50
1976	64,765	32,154	.50
1977	72,882	34,620	.48
1978	152,272	50,585	.33
1979	141,560	60,373	.43
Epoxides:			
1975	7,480	2,709	.36
1976	8,761	3,225	.37
1977	6,671	3,152	.47
1978	1,095	926	.85
1979	1,171	1,292	1.10
Halogenated hydrocarbons:			
1975	90,294	18,599	.21
1976	145,373	24,529	.17
1977	113,021	23,190	.21
1978	180,669	36,626	.20
1979	267,347	61,690	.23
Other:			
1975	34,720	16,858	0.49
1976	42,389	24,614	.58
1977	46,207	35,344	.76
1978	20,187	25,792	1.28
1979	22,794	34,180	1.50

Source: Statistics Canada, Imports Merchandise Trade.

Table A-7 .--Cyclic Intermediates: Canadian rate of duty, by tariff number

Item No.	Description	Rate of duty		
		Base Rate	M.F.N. Rate	M.T.N Concession Rate
92901-16	Styrene	15% ad val.	14.1% ad val.	7.5% ad val.
92901-17	Cyclohexane, cumene, etc.	15% ad val.	14.4% ad val.	10% ad val.
92906-1	Phenol	15% ad val.	14.3% ad val.	9.2% ad val.
92915-3	Phthalic anhydride	12½% ad val.	12½% ad val.	12½% ad val.

Source: Arthur L. Brunette Ltd., McGoldrick's Handbook of the Canadian Customs Tariff and Excise Duties 1980-81, Montreal, Canada, 1980.

Table A-8 .--Pesticides: Canadian rate of duty, by tariff number

Item No.	Description	Rate of duty		
		Base Rate	M.F.N. Rate	M.T.N. Concession Rate
93811-1	Fungicides, herbicides, insecticides.	Free	Free	Free
93811-2	When in packages not exceeding 3 pounds each gross, weight.	7.5% ad val.	7.5% ad val.	7.5% ad val.

Source: Arthur L. Brunette Ltd., McGoldrick's Handbook of the Canadian Customs Tariff and Excise Duties 1980-81, Montreal, Canada, 1980.

Table A-9 .--Nitrogenous Fertilizers: Canadian rate of duty, by tariff number

Item No.	Description	Rate of duty		
		Base Rate	M.F.N. Rate	M.T.N. Concession Rate
92816-1	Ammonia, anhydrous or in aqueous solution	10% ad val.	8.8% ad val.	Free
93102-1	Ammonium nitrate, whether or not coated or prilled	10% ad val.	Free	Free Free
93102-2	Ammonium sulphate	Free	Free	Free
93102-3	Ammonium sulphonitrate; calcium nitrate-magnesium nitrate	15% ad val.	Free	Free
93102-4	Calcium cyanamide (cyanamide, lime nitrogen) containing, in the dry state, not more than 25 percent by weight of nitrogen, whether or not treated with oil	15% ad val.	Free	Free
93102-5	Calcium nitrate containing, in the dry state, not more than 16 percent by weight of nitrogen	15% ad val.	Free	Free
93102-6	Sodium nitrate containing, in the dry state, not more than 16.3 percent by weight of nitrogen	Free	Free	Free
93102-7	Urea, whether or not coated or prilled	15% ad val.	Free	Free

Source: Arthur L. Brunette Ltd., McGoldrick's Handbook of the Canadian Customs Tariff and Excise Duties 1980-81, Montreal, Canada, 1980.

A-128

Table A-10--Nitrogenous fertilizers: Canadiam production, imports, exports, and apparent consumption, 1975-79

Year	Production	Imports	Exports	Apparent consumption
	Quantity (1,000 short tons)			
1975	2,799	89	661	2,227
1976	1,939	173	771	1,341
1977	4,289	127	1,791	1,625
1978	4,944	213	1,954	3,203
1979	4,995	228	2,008	3,215
	Value (1,000 dollars)			
1975	1/	9,387	86,495	1/
1976	1/	17,074	96,014	1/
1977	1/	14,139	179,853	1/
1978	1/	25,192	188,853	1/
1979	1/	27,952	192,538	1/
	Unit value (per short ton)			
1975	1/	$105.47	$130.85	-
1976	1/	98.69	124.43	-
1977	1/	111.33	100.42	-
1978	1/	118.27	96.49	-
1979	1/	122.60	95.89	-

1/ Not available.

Source: Ministry of Industry, Trade and Commerce, Statistics Canada, Ottawa, Canada, 1975-79.

Table A-11 --Anhydrous ammonia: Canadian production, imports, exports, and apparent consumption, 1975-79

Year	Production	Imports	Exports	Apparent consumption
	Quantity (1,000 short tons)			
1975	1,473	7	128	1,352
1976	1,531	24	249	1,306
1977	2,383	27	632	1,778
1978	2,643	61	530	2,174
1979	2,657	62	533	2,186
	Value (1,000 dollars)			
1975	1/	1,274	21,545	1/
1976	1/	3,769	30,349	1/
1977	1/	3,635	67,135	1/
1978	1/	8,205	51,118	1/
1979	1/	8,972	50,788	1/
	Unit value (per short ton)			
1975	1/	$182.00	$168.32	-
1976	1/	157.04	121.88	-
1977	1/	134.63	106.23	-
1978	1/	134.51	96.45	-
1979	1/	144.71	95.29	-

1/ Not available.

Source: Ministry of Industry, Trade and Commerce, Statistics Canada, Ottawa, Canada, 1975-79

Table A-12 --Urea: Canadian production, imports, exports, and apparent consumption, 1975-79

Year	Production	Imports	Exports	Apparent consumption
	Quantity (1,000 short ton)			
1975	362	24	113	273
1976	383	51	201	233
1977	887	65	595	357
1978	1,342	101	801	642
1979	1,336	103	828	611
	Value (1,000 dollars)			
1975	1/	2,673	22,442	1/
1976	1/	5,080	25,631	1/
1977	1/	7,213	68,459	1/
1978	1/	12,350	87,604	1/
1979	1/	13,038	86,620	1/
	Unit value (per short ton)			
1975	1/	$111.38	$198.60	-
1976	1/	99.61	127.52	-
1977	1/	110.97	115.06	-
1978	1/	122.27	109.37	-
1979	1/	126.58	104.61	-

1/ Not available.

Source: Ministry of Industry, Trade and Commerce, Statistics Canada, Ottawa, Canada, 1975-79.

Table A-13-Ammonium nitrate: Canadian production, imports, exports, and apparent consumption, 1975-79

Year	Production	Imports	Exports	Apparent consumption
	Quantity (1,000 short tons)			
1975	964	1/	179	1/
1976	1,026	1/	208	1/
1977	1,019	1/	291	1/
1978	960	1/	363	1/
1979	1,003	1/	396	1/
	Value (1,000 dollars)			
1975	1/	1/	18,156	1/
1976	1/	1/	18,625	1/
1977	1/	1/	25,934	1/
1978	1/	1/	30,223	1/
1979	1/	1/	36,781	1/
	Unit value (per short ton)			
1975	1/	1/	$101.43	-
1976	1/	1/	89.54	-
1977	1/	1/	89.12	-
1978	1/	1/	83.26	-
1979	1/	1/	92.88	-

1/ Not available.

Source: Ministry of Industry, Trade and Commerce, Statistics Canada, Ottawa, Canada, 1975-79.

Table A-14-Ammonium sulfate: Canadian production, imports, exports, and apparent consumption, 1975-79

Year	Production	Imports	Exports	Apparent consumption
	Quantity (1,000 short tons)			
1975	1/	43	140	1/
1976	1/	44	202	1/
1977	1/	22	197	1/
1978	1/	19	187	1/
1979	1/	16	196	1/
	Value (1,000 dollars)			
1975	1/	3,221	13,140	1/
1976	1/	2,577	13,437	1/
1977	1/	1,657	11,582	1/
1978	1/	1,431	12,398	1/
1979	1/	1,271	13,794	1/
	Unit value (per short ton)			
1975	1/	$74.91	$93.86	-
1976	1/	58.57	66.52	-
1977	1/	75.31	58.79	-
1978	1/	73.31	66.30	-
1979	1/	79.44	70.38	-

1/ Not available.

Source: Ministry of Industry, Trade and Commerce, Statistics Canada, Ottawa, Canada, 1975-79.

Table A-15-Nitrogen solutions: Canadian production, imports, exports, and apparent consumption, 1975-79

Year	Production	Imports	Exports	Apparent consumption
	Quantity (1,000 short tons)			
1975	1/	2	101	1/
1976	1/	30	93	1/
1977	1/	6	76	1/
1978	1/	3	64	1/
1979	1/	17	54	1/
	Value (1,000 dollars)			
1975	1/	187	11,212	1/
1976	1/	1,627	7,972	1/
1977	1/	595	6,743	1/
1978	1/	288	6,277	1/
1979	1/	1,519	4,555	1/
	Unit value (per short ton)			
1975	1/	$93.50	$111.01	-
1976	1/	87.57	85.72	-
1977	1/	99.17	88.72	-
1978	1/	96.00	98.08	-
1979	1/	89.35	84.35	-

1/ Not available.

Source: Ministry of Industry, Trade and Commerce, Statistics Canada, Ottawa, Canada, 1975-79.

Table A-16--Other nitrogenous fertilizers: Canadian production, imports, exports, and apparent consumption, 1975-79

Year	Production	Imports	Exports	Apparent consumption
	Quantity (1,000 short tons)			
1975	1/	14	1/	1/
1976	1/	24	1/	1/
1977	1/	7	1/	1/
1978	1/	28	1/	1/
1979	1/	29	1/	1/
	Value (1,000 dollars)			
1975	1/	2,032	1/	1/
1976	1/	3,021	1/	1/
1977	1/	1,039	1/	1/
1978	1/	2,918	1/	1/
1979	1/	3,152	1/	1/
	Unit value (per short ton)			
1975	1/	$145.14	1/	-
1976	1/	125.88	1/	-
1977	1/	148.43	1/	-
1978	1/	104.21	1/	-
1979	1/	108.69	1/	-

1/ Not available.

Source: Ministry of Industry, Trade and Commerce, Statistics Canada, Ottawa, Canada, 1975-79.

Table A-17 --Synthetic Rubber: Canadian rate of duty, by tariff number

Item No.	Description	Rate of duty		
		Base Rate	M.F.N. Rate	M.T.N. Concession Rate
61605-1	Styrene-butadiene rubber	2.5% ad val.	2.2% ad val.	Free
61605-1	Butyl rubber	2.5% ad val.	2.2% ad val.	Free
61605-1	Nitrile rubber	2.5% ad val.	2.2% ad val.	Free
61605-1	Polybutadiene rubber	2.5% ad val.	2.2% ad val.	Free
61605-1	Polyisoprene rubber	2.5% ad val.	2.2% ad val.	Free
61605-1	Ethylene-propylene rubber	2.5% ad val.	2.2% ad val.	Free
61605-1	Other (synthetic rubber n.e.s./ except lates).	2.5% ad val.	2.2% ad val.	Free
61605-1	Rubber, crude, caoutchouc or india-rubber, unmanufactured, n.o.p.	2.5% ad val.	2.2% ad val.	Free

Source: Arthur L. Brunette Ltd., McGoldrick's Handbook of the Canadian Customs Tariff and Excise Duties 1980-81, Montreal, Canada, 1980.

Table A-18 --Synthetic rubber: Canadian production, imports, exports, and apparent consumption, 1975-79

Year	Production	Imports	Exports 1/	Apparent consumption 1/
	Quantity (1,000 pounds)			
1975	1/ 381,400	2/	165,400	2/
1976	462,840	2/	207,200	2/
1977	524,552	2/	247,600	2/
1978	546,592	68,969	288,400	327,161
1979	1/ 606,265	89,988	308,600	387,653
	Value (1,000 U.S. dollars)			
1975	2/	2/	61,198	2/
1976	2/	2/	82,880	2/
1977	2/	2/	99,040	2/
1978	2/	26,488	115,360	2/
1979	2/	38,806	126,526	2/
	Unit value (dollars per pound)			
1975	2/	2/	.37	-
1976	2/	2/	.40	-
1977	2/	2/	.40	-
1978	2/	.38	.40	-
1979	2/	.43	.41	-

1/ Estimated.
2/ Not available.

Table A-19--Manmade fibers from petrochemicals: Canadian production, foreign trade, apparent consumption, and ratio of imports to consumption, 1975-79

Year	Production	Imports	Exports	Apparent consumption	Ratio (percent) of imports to consumption
	Quantity (1,000 pounds)				
1975	211,239	119,290	12,128	318,401	37.5
1976	224,690	142,002	11,466	355,226	40.0
1977	253,134	110,691	7,718	356,107	31.1
1978	261,292	110,470	37,926	333,836	33.1
1979	268,128	187,204	32,193	423,139	44.2
	Value (1,000 dollars)				
1975	195,396	100,204	7,398	288,202	34.8
1976	204,468	122,262	7,224	319,506	38.3
1977	226,808	95,194	4,708	317,294	30.0
1978	228,892	96,109	24,273	300,728	32.0
1979	237,561	164,739	20,925	381,375	43.2
	Unit value (per pound)				
1975	$0.92	$0.84	.61		
1976	.91	.86	.63		
1977	.90	.86	.61		
1978	.88	.87	.64		
1979	.89	.88	.65		

Source: Quantity, Textile Organon, a publication of the Textile Economics Bureau; value in Canadian dollars, estimated from Statistics Canada, a publication of the Canadian government.

Table A-20--Cellulosic manmade fibers, including filament yarn: Canadian production, imports, exports, and apparent consumption, 1975-79

Year	Production	Imports	Exports	Apparent consumption
	Quantity (1,000 pounds)			
1975	61,100	11,500	17,400	55,200
1976	59,300	23,200	15,700	66,800
1977	82,100	32,400	11,900	102,600
1978	86,200	43,900	25,200	104,900
1979	100,100	28,000	57,600	70,500

Source: Textile Organon.

Table A-21--Cellulosic manmade fibers, including filament yarn: Canadian imports and exports, by types, 1975-79

Type	1975	1976	1977	1978	1979
	Quantity (1,000 pounds)				
Imports:					
Cellulosic yarn	6,400	10,400	20,500	19,000	19,000
Cellulosic staple	5,100	12,800	11,900	24,900	9,000
Total	11,500	23,200	32,400	43,900	28,000
Exports:					
Cellulosic yarn	4,400	4,200	5,700	9,500	9,300
Cellulosic staple	13,000	11,500	6,200	15,700	48,300
Total	17,400	15,700	11,900	25,200	57,600

Source: Textile Organon.

Table A-22 --Selected Synthetic Plastics Materials: Canadian rate of duty, by tariff number

Item No.	Description	Rate of duty		
		Base Rate	M.F.N. Rate	M.T.N. Concession Rate
93902-3	Polyethylene type	10% ad val.	9.9% ad val.	9.5% ad val.
93902-4	Polypropylene type	10% ad val.	9.9% ad val.	9.5% ad val.
93902-13	Polyvinyl chloride type including polyvinyl chloroacetate; polystyrene type, n.o.p.	10% ad val.	9.9% ad val.	9.5% ad val.

1/ Includes only aqueous emulsions, aqueous dispersions or aqueous solutions, without other admixture. Does not include such resins dissolved in organic solvents, where the weight of the solvent does not exceed 50 percent of the weight of the solution, without other admixture; nor does it include moulding composition, n.o.p. These named resins in other forms are dutiable at separate rates.

Source: Arthur L. Brunette Ltd., McGoldrick's Handbook of the Canadian Customs Tariff and Excise Duties 1980-81, Montreal, Canada, 1980.

Table A-23.--Synthetic resins and plastics materials: Canadian shipment, imports, exports, and apparent consumption, 1975-79

Year	Shipments	Imports	Exports	Apparent consumption
	Quantity (1,000 pounds)			
1975	862,155	646,678	282,560	1,226,273
1976	1,048,511	780,901	353,614	1,511,798
1977	1,226,108	886,048	428,432	1,683,724
1978	1,590,178	997,091	686,249	1,901,020
1979	1,962,695	1/ 937,734	2/ 834,062	2,066,367
	Value (1,000 U.S. dollars) 3/			
1975	422,898	237,921	101,540	559,279
1976	526,601	303,358	134,220	695,739
1977	589,599	353,691	161,424	781,866
1978	723,427	422,221	227,014	918,634
1979	4/	1/ 466,479	2/ 301,909	4/
	Unit value (per pound)			
1975	5/	37	36	-
1976	5/	39	38	-
1977	5/	40	38	-
1978	5/	42	33	-
1979	5/	50	36	-

1/ Statistics Canada, Trade of Canada, Imports by Commodities, December 1979.
2/ Statistics Canada, Trade of Canada, Exports by Commodities, December 1979.
3/ Conversion from Canadian dollars from Board of Governors of the Federal Reserve System, Federal Reserve Bulletin, August 1978, 1979 and 1980.
4/ Not available.
5/ Not representative.

Source: Quantity of shipments, compiled from Statistics Canada, Specific Chemicals, Catalogue 46-002 monthly; value of shipments compiled from Statistics Canada, Manufacturers of Plastics and Synthetic Resins, Catalogue 46-211 annual. Imports, except as noted, compiled from Statistics Canada, Trade of Canada, Imports, Merchandise Trade, 1975-77 and 1976-78; exports, except as noted, compiled from Statistics Canada, Trade of Canada, Exports, Merchandise Trade, 1975-77 and 1976-78.

Note.--The volume of shipments are for certain key resins; namely, polyethylene, polystyrene, PVC and unsaturated polyesters. Therefore, the ratio of exports to shipments on a volume basis is somewhat overstated. Industry sources estimate that the key resins covered here annually account for two-thirds to three-fourths of the total plastics production.

The value of shipments includes all resins but is reported to be understated by 30-40 percent annually. This results from Statistics Canada publishing data on the basis of an "establishment concept." Under this concept, shipments of all goods from a plant or establishment are aggregate into the category represented by the principal items of that establishment or plant. Industry sources claim that by using this procedure the value of plastics shipments of two of the leading producers have not been credited to the plastics industry.

A-142

Table A-24 --Synthetic resins and plastics materials: Percentage distribution of Canadian shipments of key plastics products, by volume, 1975-79

(In percent)

Product	1975	1976	1977	1978	1979
Polyethylene	62.9	61.2	62.0	66.2	66.4
Polystyrene	15.2	15.4	15.3	13.7	13.4
Polyvinyl chloride (PVC)	17.9	19.7	17.9	17.3	17.1
Polyesters, unsaturated	4.0	3.7	4.8	2.8	3.1
Total	100.0	100.0	100.0	100.0	100.0

Source: Statistics Canada, Specific Chemicals, Catalogue 46-002 monthly.

Table A-25--Polyethylene resins: Canadian shipments, imports, exports, and apparent consumption, 1975-79

Year	Shipments	Imports	Exports	Apparent consumption
	Quantity (1,000 pounds)			
1975	542,640	148,397	33,891	657,146
1976	663,389	201,021	50,528	813,882
1977	760,687	236,270	71,061	925,896
1978	1,052,712	205,017	242,440	1,015,289
1979	1,302,982	1/ 151,806	2/ 335,990	1,118,798
	Value (1,000 dollars) 3/			
1975	4/	42,622	10,228	-
1976	4/	62,019	13,890	-
1977	4/	70,747	19,923	-
1978	4/	60,346	56,843	-
1979	4/	51,783	105,377	-
	Unit value (per pound)			
1975	4/	29	30	-
1976	4/	30	27	-
1977	4/	30	28	-
1978	4/	30	24	-
1979	4/	34	31	-

1/ Statistics Canada, Trade of Canada, Imports by Commodities, December 1979.

2/ Statistics Canada, Trade of Canada, Exports by Commodities, December 1979.

3/ Conversion from Canadial dollars from Board of Governors of the Federal Reserve System, Federal Reserve Bulletin, August 1978, 1979 and 1980.

4/ Not available.

Source: Production, compiled from Statistics Canada, Specific Chemicals; imports, except as noted, compiled from statistics Canada, Trade of Canada Imports Merchandise Trade, 1975-77 and 1976-78; exports, except as noted, compiled from Statistics Canada, Trade of Canada, Exports, Merchandise Trade, 1975-77 and 1976-78.

Table A-26--Polystyrene resins: Canadian shipments, imports, exports, and apparent consumption, 1975-79

Year	Shipments	Imports	Exports	Apparent consumption
	Quantity (1,000 pounds)			
1975	130,755	37,742	4,344	164,153
1976	167,403	39,954	6,312	201,045
1977	187,766	51,318	12,241	226,843
1978	217,695	75,582	21,604	271,637
1979	263,847	1/ 60,089	2/ 29,103	294,833
	Value (1,000 U.S. dollars) 3/			
1975	4/	13,176	1,182	-
1976	4/	14,510	1,805	-
1977	4/	18,337	3,788	-
1978	4/	27,064	6,613	-
1979	4/	1/ 43,125	2/ 11,363	-
	Unit value (per pound)			
1975	4/	35	27	-
1976	4/	36	29	-
1977	4/	36	31	-
1978	4/	36	31	-
1979	4/	72	39	-

1/ Statistics Canada, Trade of Canada, Imports by Commodities, December 1979.

2/ Statistics Canada, Trade of Canada, Exports by Commodities, December 1979.

3/ Conversion from Canadian dollars from Board of Governors of the Federal Reserve System, Federal Reserve Bulletin, August 1978, 1979 and 1980.

4/ Not available.

Source: Production, compiled from Statistics Canada, Specific Chemicals, Catalogue 46-002 monthly; imports, except as noted, compiled from Statistics Canada, Trade of Canada, Imports, Merchandise Trade, 1975-77 and 1976-78; exports, except as notes, compiled from Statistics Canada, Trade of Canada, Exports Merchandise Trade, 1975-77 and 1976-78.

Table A-27--Polyvinyl chloride (PVC) resins: Canadian shipments and imports, 1975-79

(Quantity in thousands of pounds; value in thousands of U.S. dollars; unit value in cents per pound)

Year	Shipments	Imports
	Quantity	
1975	154,161	78,264
1976	213,267	98,419
1977	219,795	99,545
1978	275,032	112,576
1979	335,971	1/ 118,946
	Value 2/	
1975	3/	22,013
1976	3/	30,785
1977	3/	31,675
1978	3/	35,910
1979	3/	1/ 41,518
	Unit value	
1975	3/	29
1976	3/	31
1977	3/	32
1978	3/	32
1979	3/	35

1/ Statistics Canada, Trade of Canada, Imports by Commodities, December 1979.

2/ Conversion from Canadian dollars from Board of Governors of the Federal Reserve System, Federal Reserve Bulletin, August 1978, 1979 and 1980.

3/ Not available.

Source: Production, compiled from Statistics Canada, Specific Chemicals, Catalogue 46-002 monthly; imports, except as noted, compiled from Statistics Canada, Trade of Canada, Imports, Merchandise Trade, 1975-77 and 1976-78.

Table A-28--Synthetic resins and plastics materials: Canadian ratios of imports to consumption, exports to shipments and imports to exports, 1975-79

Year	Ratio (percent) of-- Imports to consumption	Exports to shipments	Imports to exports
	Quantity		
1975	52.7	32.8	228.9
1976	51.7	32.6	220.8
1977	52.6	34.9	206.8
1978	52.4	43.2	145.3
1979	45.4	42.5	112.4
	Value		
1975	42.5	24.0	234.3
1976	43.6	25.5	226.0
1977	45.2	27.4	217.8
1978	46.0	31.4	186.0
1979	1/	1/	154.5

1/ Not available.

Source: Derived from data in table A-23.

Table A-29--Polyethylene resins: Canadian ratios of imports to consumption, exports to shipments and imports to exports, 1975-79

Year	Ratio (percent) of--		
	Imports to consumption	Exports to shipments	Imports to exports
	Quantity		
1975	22.6	6.2	437.9
1976	24.7	7.6	397.8
1977	25.5	9.3	332.5
1978	20.2	23.0	84.5
1979	13.6	25.8	45.2
	Value		
1975	-	-	416.7
1976	-	-	446.5
1977	-	-	355.1
1978	-	-	106.0
1979	-	-	49.1

Source: Derived from data in table A-25.

Table A-30--Polystyrene resins: Canadian ratios of imports to consumption, exports to shipments and imports to exports, 1975-79

Year	Ratio (percent) of-- Imports to consumption	Exports to shipments	Imports to exports
	Quantity		
1975	23.0	3.3	868.9
1976	19.9	3.8	633.0
1977	22.6	6.5	419.2
1978	27.8	9.9	349.9
1979	20.4	11.0	206.5
	Value		
1975	-	-	1114.7
1976	-	-	803.9
1977	-	-	484.1
1978	-	-	409.3
1979	-	-	379.5

Source: Derived from data in table A-26.

Table A-31 --Polyvinyl chloride (PVC) resins: Ratio of imports to shipments, 1975-79

Year	Ratio (percent) of imports to shipments
	Quantity
1975	50.8
1976	46.1
1977	45.3
1978	40.9
1979	35.4
	Value
1975	-
1976	-
1977	-
1978	-
1979	-

Source: Derived from data in table A-27.

Table A-32 --Synthetic resins and plastics materials: Ratios of Canadian imports from the United States to total Canadian imports, by product, 1975-79

(In percent)

Product	1975		1976		1977		1978		1979	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Polyethylene	77.7	77.6	96.3	96.4	93.4	94.7	91.8	94.2	99.4	99.3
Polystyrene	96.0	97.1	96.8	97.1	98.7	98.7	98.9	98.5	98.9	98.9
Polyvinyl chloride (PVC)	81.9	82.3	83.3	82.9	86.9	87.0	85.8	86.5	89.5	87.5

Source: Statistics Canada, Trade of Canada, Imports by Commodities, December 1979 and Trade of Canada, Imports, Merchandise Trade, 1975-77 and 1976-78.

A-151

Table A-33.--Polyethylene resins: Percentage distribution of total Canadian exports to exports to the four major markets, and to Mexico, 1/ 1975-79

Year and market	Quantity	Value
1975:		
Austria	17.6	16.4
United States	9.5	9.7
Denmark	9.4	8.8
Spain	6.9	6.9
Mexico	.5	.4
1976:		
United States	24.3	24.9
Korea	13.4	10.1
Australia	7.5	9.6
United Kingdom	5.9	5.8
Mexico	.5	.5
1977:		
United States	16.4	16.0
United Kingdom	7.1	7.2
Brazil	9.2	7.1
Korea	7.1	5.4
Mexico	.2	.2
1978:		
United States	16.2	17.6
Korea	8.5	6.9
Philippines	6.7	6.2
Brazil	6.4	5.9
Mexico	1.5	1.4
1979:		
United States	19.3	17.8
Korea	9.3	10.3
Australia	4.7	6.0
Philippines	5.6	4.3
Mexico	3.3	.5

1/ The United States was the only continuing major market during the period 1975-79. Mexico has not been a major market during this period and was included only for comparative purposes.

Source: Statistics Canada, Trade of Canada, Exports by Commodities, December 1979 and Trade of Canada, Exports, Merchandise Trade, 1975-77 and 1975-78.

Table A-34 --Other Petrochemical derivatives: Canadian rate of duty, by tariff number

Item No.	Description	Rate of duty		
		Base Rate	M.F.N. Rate	M.T.N. Concession Rate
92908-2 92935-3	Essential oils, natural or synthetic	7.2% ad val.	7.2% ad val.	7.2% ad val.
93205	Synthetic organic dyestuffs (including pigment dyestuffs)			
93205-1	Other than the following	Free	Free	Free
93205-2	Quinacridone pigment dyestuffs	5% ad val.	5% ad val.	5% ad val.
93205-3	Pigment dyestuffs	15% ad val.	14.7% ad val.	14.4% ad val.
93206	Color lakes			
93206-1	Colour lakes	15% ad val.	14.7% ad val.	14.4% ad val.
93402	Organic surface-active agents, and preparations			
93402-1	Organic surface-active agents, and preparations	15% ad val.	14.7% ad val.	14.4% ad val.
93601	Propellant powders			
93601-1	Propellant powders	10.5% ad val.	10.5% ad val.	10.5% ad val.
93601-2	Black powder	Free	Free	Free
93602	Prepared explosives			
93602-1	Prepared explosives	12.5% ad val.	12.5% ad val.	12.5% ad val.
93819-1	Other chemical products and preparations, including various plasticizers and rubber-processing chemicals	15% ad val.	14.7% ad val.	14.4% ad val.

Source: Arthur L. Brunette, Ltd., McGoldrick's Handbook of the Canadian Tariff and Excise Duties, 1980-81, Montreal, Canada, 1980.

A-153

Table A-35 --Selected surface-active agents: Canadian production, imports, and exports 1975-79

Year	Production	Imports	Exports
	Quantity (1,000 pounds)		
1975	1/	53,757	1/
1976	1/	51,632	1/
1977	1/	60,419	1/
1978	1/	72,171	1/
1979	1/	64,609	1/
	Value (1,000 Canadian dollars)		
1975	1/	22,052	1/
1976	1/	22,433	1/
1977	1/	27,842	1/
1978	1/	34,802	1/
1979	1/	34,914	1/
	Unit value (per pound)		
1975	1/	$0.41	1/
1976	1/	.43	1/
1977	1/	.46	1/
1978	1/	.48	1/
1979	1/	.54	1/

1/ Not available.

Source: Ministry of Industry, Trade and Commerce, Statistics Canada, Ottawa, Canada, 1975-79

Note.--There is limited Canadian production of surface-active agents, consisting primarily of ethoxylates, ethanolamines and some anionics.

Table A-36--Organic pigments (color lakes and tones): Canadian production, imports, and exports, 1975-79

Year	Production	Imports	Exports
	Quantity (1,000 pounds)		
1975	1/		25,011
1976	1/	23,800	26,747
1977	1/	20,600	11,243
1978	1/	24,500	11,103
1979	1/	27,900	12,860
	Value (1,000 Canadian dollars)		
1975	1/		12,516
1976	132,000	28,600	13,941
1977	153,000	30,100	8,550
1978	159,000	43,700	7,812
1979	1/	60,500	11,275
	Unit value (per pound)		
1975	1/		$0.50
1976	1/	$1.20	.52
1977	1/	1.46	.76
1978	1/	1.78	.70
1979	1/	2.17	.88

1/ Estimated.

Source: Ministry of Industry, Trade and Commerce, Statistics Canada, Ottawa, Canada, 1975-79.

Table A-37--Carbon black: Canadian production, imports, and exports, 1975-79

Year	Production 1/	Imports	Exports
	Quantity (1,000 pounds)		
1975	2/		2/
1976	2/	20,000	2/
1977	464,500	14,400	2/
1978	435,000	18,100	2/
1979	2/	31,500	2/
	Value (1,000 Canadian dollars)		
1975			2/
1976		3,500	2/
1977	48,900	3,100	2/
1978	53,800	4,500	2/
1979		6,800	2/
	Unit value (per pound)		
1975	2/		2/
1976	2/	$0.18	2/
1977	$0.11	.22	2/
1978	.12	.25	2/
1979	2/	.19	2/

1/ Includes small production of acetylene black.
2/ Not available.

Source: Ministry of Industry, Trade and Commerce, Statistics Canada, Ottawa, Canada, 1975-79.

Table A-38 --Plasticizers: Canadian production, imports, and exports, 1975-79

Year	Production 1/	Imports	Exports
	Quantity (1,000 pounds)		
1975			2/
1976		19,800	2/
1977	81,000	22,900	2/
1978	85,000	24,400	2/
1979	88,000	15,900	2/
	Value (1,000 Canadian dollars)		
1975	2/		2/
1976	2/	6,400	2/
1977	2/	7,500	2/
1978	2/	9,000	2/
1979	2/	7,500	2/
	Unit value (per pound)		
1975	2/		2/
1976	2/	$0.32	2/
1977	2/	.33	2/
1978	2/	.37	2/
1979	2/	.47	2/

1/ Estimated.
2/ Not available.

Source: Ministry of Industry, Trade and Commerce, Statistics Canada, Ottawa, Canada, 1975-79.

Table A-39.--Selected organic dyes: Canadian production, imports exports, 1975-79

Year	Production 1/	Imports	Exports 2/
	Quantity (1,000 pounds)		
1975	1/		25,011
1976	1/	18,300	26,747
1977	1/	18,900	11,243
1978	1/	22,000	11,103
1979	1/	23,300	12,860
	Value (1,000 Canadian dollars)		
1975	1/		12,516
1976	1/	46,100	13,941
1977	1/	52,300	8,550
1978	1/	45,400	7,811
1979	1/	81,960	11,275
	Unit value (per pound)		
1975	1/		$0.50
1976	1/	$2.57	.52
1977	1/	2.77	.76
1978	1/	2.06	.70
1979	1/	3.52	.88

1/ There is no Canadian production of organic dyestuffs.

2/ Canadian commodity no. 427.99: dyestuffs, pigments, lakes and toners.

Source: Ministry of Industry, Trade and Commerce, Statistics Canada, Ottawa, Canada, 1975-79.

Note: The variation in unit values between 1976 and 1979 is a reflection of the variation in the product mix of the organic dyes.