Petrochemicals

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Canada

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

1990–1991

PETROCHEMICALS

FOREWORD

In a rapidly changing global trade environment, the international competitiveness of Canadian industry is the key to growth and prosperity. Promoting improved performance by Canadian firms in the global marketplace is a central element of the mandates of Industry, Science and Technology Canada and International Trade Canada. This Industry Profile is one of a series of papers in which Industry, Science and Technology Canada assesses, in a summary form, the current competitiveness of Canada's industrial sectors, taking into account technological, human resource and other critical factors. Industry, Science and Technology Canada and International Trade Canada assess the most recent changes in access to markets, including the implications of the Canada-U.S. Free Trade Agreement. Industry participants were consulted in the preparation of the profiles.

Ensuring that Canada remains prosperous over the next decade and into the next century is a challenge that affects us all. These profiles are intended to be informative and to serve as a basis for discussion of industrial prospects, strategic directions and the need for new approaches. This 1990–1991 series represents an updating and revision of the series published in 1988–1989. The Government will continue to update the series on a regular basis.

Michael H. Wilson
Minister of Industry, Science and Technology
and Minister for International Trade

Structure and Performance

Structure

Petrochemicals are organic chemicals manufactured from feedstocks of crude oil and natural gas. These feedstocks are converted into first-stage or primary petrochemicals, the most important of which are olefins, including ethylene, propylene and butadiene, aromatics such as benzene, toluene and xylenes, and methanol. Although ammonia is produced from natural gas, it is not an organic chemical and is not included in the statistics presented in this profile; it is included in a separate industry profile on *Fertilizers*.

Primary petrochemicals are upgraded to intermediates such as styrene, ethylene dichloride and synthetic resins, including polyethylene and polyvinyl chloride. The intermediates are all considered part of the petrochemicals industry, even though synthetic resins are also considered in a separate industry profile on *Synthetic Resins*. Intermediates in turn are the raw materials for a wide range of downstream industries such as the synthetic rubber, plastics processing, paints, inks, adhesives and synthetic fibres industries. The producers of primary petrochemicals and intermediates are interdependent, and both rely on downstream customers. Downstream industries have the choice of sourcing their raw materials from domestic or foreign suppliers.

The petrochemicals industry had shipments of more than $6.7 billion in 1989 (Figure 1). The United States is by far Canada's most important petrochemical trading partner, taking 55.1 percent of Canadian exports in 1989 and supplying 74.3 percent of Canadian imports. The European Community (EC) supplied 15.6 percent of Canadian imports

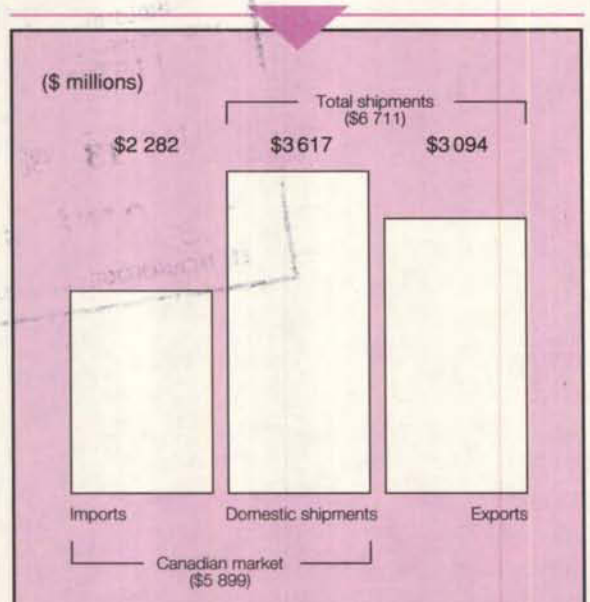
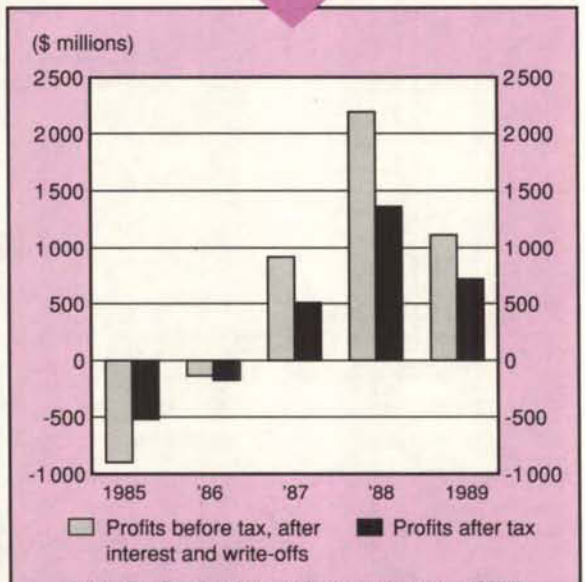


Figure 1 — Imports, Exports and Domestic Shipments, 1989



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

Figure 2 — Petrochemical Industry Profitability

and took 12.6 percent of exports. Japan is the destination for 8.2 percent of Canadian exports. The major products exported include styrene, ethylene glycol, methanol and polyethylene resins. Imports include specialty resins, solvents, polyesters and terephthalic acid.

Production capacity is spread over 54 plant sites in four provinces, with Ontario accounting for 58.2 percent, Alberta 25.4 percent, Quebec 14.0 percent and British Columbia 1.9 percent of shipments. The newer, Western Canadian subsector is primarily gas-based, while the Eastern Canadian subsector was developed to use mainly oil-based raw materials. Direct employment in the industry was approximately 14 500 in 1989. Because more labour-intensive downstream industries tend to locate near their markets, most related employment has been in Ontario and Quebec. The growth of the petrochemicals industry in Alberta has, however, added some downstream jobs in that province.

Companies in the industry for the most part are large multinationals, the majority being foreign controlled. As a result of the Canada-U.S. Free Trade Agreement (FTA), integration with foreign (mainly U.S.-based) parents is important for companies such as Celanese, Dow Chemical, Esso Chemical and Union Carbide as the industry develops North American marketing strategies. Novacor Chemicals and Pétromont are the only major Canadian-owned companies. Public sector ownership in the industry is limited to the Quebec government's 50 percent partnership, through La Société générale de financement, in Pétromont, the ethylene/polyethylene producer.

Performance

Much of the new petrochemical capacity built in the world during the late 1970s and early 1980s was sited in energy-rich locations, including Alberta, since security and cost of feedstock supply were of prime concern. Access to secure domestic supplies of crude oil and natural gas was the basis upon which the Canadian industry developed. Canadian energy prices were federally regulated below world levels to give the Canadian manufacturing industry a cost advantage. With ever-increasing world energy prices during this period, Alberta's land-locked ethylene-derivative producers expected to reap a continuing raw material advantage from their cost-of-service contracts, under which the price of ethylene would increase only if the cost of production increased.

Demand for petrochemicals in developed countries mirrors general economic activity. Because long construction periods of up to three years are required to build world-scale plants, investment activity does not always match demand cycles. This can lead to extended periods of worldwide oversupply and a significant erosion of petrochemical prices, particularly for the large-volume commodities that comprise most of Canada's petrochemical exports.

The effects of petrochemical price declines in the early 1980s were exaggerated by declining energy prices in the rest of the world, while controlled Canadian energy prices continued to increase. The petrochemicals industry had before-tax losses of more than $1.7 billion in the five-year period ending in 1986. The subsequent recovery continued strongly through the end of 1988 (Figure 2) as world supply/demand came into

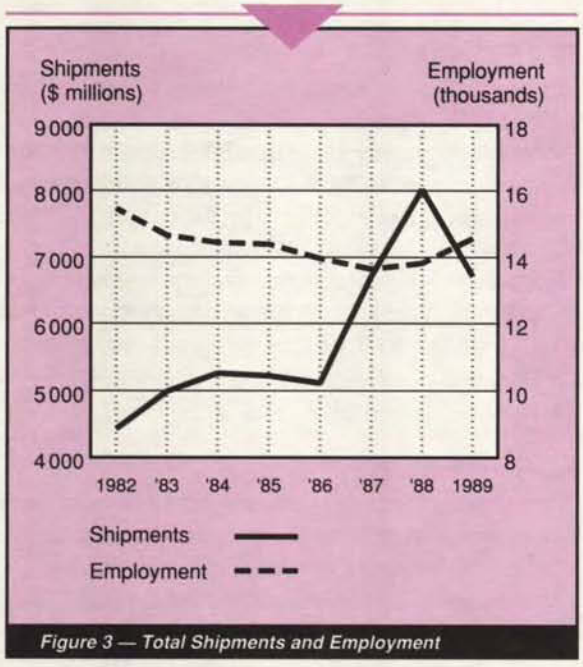


Figure 3 — Total Shipments and Employment

balance and product prices improved dramatically. In the worldwide record-breaking year of 1988, the Canadian industry enjoyed petrochemical sales of more than $8 billion and a trade surplus of $1.2 billion (Figure 3). A 33 percent decline in the trade surplus occurred in 1989 as a result of weakening demand and subsequent overcapacity in commodity chemicals. The trend worsened in 1990. The decline continued into 1991 as the downturn became a recession in North America and other parts of the world. With the signs of recovery, though still uneven, the medium-term outlook will correspondingly improve. The overall impact on the industry will depend on the pace of recovery.

Strengths and Weaknesses

Structural Factors

The major cost components of the petrochemicals industry are feedstocks and capital. Hydrocarbons (oil and gas) represent 60 to 70 percent of the cost of production (raw materials plus energy). Capital (initial plant cost plus maintenance) accounts for 25 to 35 percent.

A strength of the Canadian industry is that, in large part, its plants are modern and world-competitive in scale and technology. However, some older plants, mainly in Eastern Canada, are smaller than world-scale.

Capital costs tend to be higher in Canada than in the U.S. Gulf Coast area, where the principal competition is located. Reasons include higher labour costs, a lack of industry concentration and a harsher climate in Canada. When much of the existing Canadian industry was built (late 1970s and early 1980s), the relative capital cost disadvantage ranged from 15 percent in Eastern Canada to about 25 percent in Western Canada. While the Canadian cost disadvantage of new plants has been reduced in recent years because of improved infrastructure and engineering expertise, it is generally still in the range of 10 to 20 percent.

Canadian producers supplying the relatively small, widely dispersed domestic market, as well as offshore export markets, face higher transportation costs than competitors located on the U.S. Gulf Coast. However, with reduced tariffs under the FTA, Canadian plants will be able to supply nearby U.S. markets as "domestic equivalent" markets, with consequent freight savings.

Nonetheless, in trying to attract new investment, Canadian producers still have to offset the capital cost differential and higher combined federal and provincial corporate taxation rates with advantages such as a lower cost for hydrocarbons. However, energy pricing deregulation in Canada has eliminated oil-based, and has drastically reduced gas-based, hydrocarbon cost advantages that Canadian petrochemical producers enjoyed in the early 1980s.

Feedstock flexibility investments, to allow the use of natural gas liquids (NGL) as well as oil-based feedstocks, have enabled Eastern Canadian oil-based ethylene producers to improve their competitiveness. The proposed Soligaz pipeline project that is being considered to bring NGLs to Montreal would permit Pétromont to optimize its NGL-use capability.

Trade-Related Factors

Since the majority of Canadian petrochemical exports go to the United States, the elimination of tariffs under the FTA is very important to the petrochemicals industry. Most petrochemical tariffs are being phased out in five equal, annual reductions, ending 1 January 1993. A few products, including ethanol, are subject to a 10-step phase-out ending 1 January 1998. Exports to other countries are assessed the Most Favoured Nation (MFN) rate established under the terms of the General Agreement on Tariffs and Trade (GATT). Examples of rates for a number of the commodity chemicals produced in Canada are shown in the table on page 4.

Preferential access of Canadian products to the U.S. market under the FTA improves the profitability and competitiveness of the export-market-oriented, Western Canadian gas-based sector. This access also enhances the prospects for further gas-based investments in Alberta to serve the North American market. However, the significant drop in world petrochemical prices, due to a softening in demand coupled

Tariffs on Selected Canadian-Produced Petrochemicals, 1 January 1991

	Canada		United States		EC	Japan
	FTA	MFN	FTA	MFN	MFN	MFN
Primary						
Ethylene	0%	0%	0%	0%	0%	5.8%
Methanol	0%	10%	0%	18%	13%	3.9%
Intermediate						
Ethylene dichloride	0%	10%	0.5¢/kg +1.3%	1.3¢/kg +3.3%	12%	5.8%
Ethylene glycol	4%	10%	4.8%	12%	13%	9.6%
Polyethylene	4%	10.2%	5%	12.5%	12.5%	22.4 yen[a]/kg
Styrene	3%	7.5%	2.9%	7.4%	6%	6.4%

[a] As of September 1991, one yen equalled C$0.008467.

with the high value of the Canadian dollar during the latter half of 1989 and into 1990, has more than offset the profitability improvements expected from tariff reductions, and some expansion plans have been delayed.

Tariff elimination also provides growth opportunities for the domestic-market-oriented Eastern Canadian producers of ethylene and its derivatives. While not enjoying any feedstock advantage over U.S. Gulf Coast competitors, these Eastern Canadian producers have lower distribution costs to serve northeastern U.S. markets.

Other major issues that could affect Canadian investment and trade include the development of a single European market with the integration of the European economies that will be in place after 1992 (EC-92), the recent political changes in Eastern Europe, the Uruguay Round of multilateral trade negotiations (MTNs) under GATT and a Canada-United States-Mexico free trade agreement.

EC-92 is not expected to provide major market opportunities for Canadian firms. More impact is expected from the general "globalization" of the chemical industry. This will see rationalization of production sites and future investment in world-scale facilities based on their proximity to markets and feedstock sources or on transportation advantages and a favourable investment climate, rather than on serving a domestic customer base.

The emergence of Eastern Europe as a potential market for Western petrochemical products will present opportunities in the long term. In the near term, Eastern European countries are faced with relatively high-cost inputs, a lack of foreign currency for trading and serious environmental problems. Therefore, these countries are unlikely to be active participants in international chemicals trade for a number of years.

Global tariff reductions resulting from the Uruguay Round of MTNs would improve Canada's ability to compete in export markets other than the United States. While offshore producers can be expected to be aggressive competitors in the Canadian market as a result of such tariff reductions, adding to competition, this is not expected to displace Canadian supply to domestic petrochemical markets. Imports are expected to continue to supply about 40 percent of domestic consumption.

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

Technological Factors

Access to technology is not a problem for firms in this industry. It operates principally on imported technology, which is freely available under licensing agreements. Annual investment by firms in this industry in process upgrading and maintenance is approximately $250 million.

The industry's recognition of the importance of science and technology to its long-term international competitiveness is exemplified by the establishment in 1985 of the industry-initiated Institute for Chemical Science and Technology (ICST). This is an industry/university consortium, supported by the federal government, dedicated to precompetitive research for the chemical, petrochemical and petroleum processing industries.

The total expenditures of the chemical industry on research and development (R&D) in Canada amounts to about 1.4 percent of sales. Statistics specific to petrochemical R&D are not available. Much of the industry's R&D activity is concentrated on providing technical support to customers, facilitating technology transfer and assisting in the development of new applications and products. Synthetic rubber from Polysar Rubber Corporation (recently acquired by Bayer AG from Nova) and linear low-density polyethylene from Du Pont Canada are examples of Canadian-developed technologies that are licensed internationally.

Environmental Regulatory Issues

Major new capital project proposals now require a thorough examination of potential environmental impact and must incorporate elements of sustainable development. The Responsible Care policy adopted by the members of the Canadian Chemical Producers' Association (CCPA) has been designed as a cradle-to-grave approach to the responsible management of chemicals. This has resulted in initiatives to update existing facilities and processes and in significant improvements in the handling and processing of chemicals.

CCPA members produce approximately 90 percent of Canadian petrochemical shipments.

Capital costs for future petrochemical facilities will increase by about 10 percent as a result of new environmental requirements. These include costs for reducing raw material needs, improving energy efficiency, increasing recycling of by-products, reducing the amount of waste material generated and treating wastes to render them non-hazardous. Similar capital cost increases will apply to new facilities being built in the United States. The cost impact of some of these initiatives will be partially offset by a resulting drop in operating costs.

Regulatory initiatives regarding hazardous waste shipments, elimination of chlorofluorocarbon (CFC) use, reduction of volatile organic compound content in many products and notification requirements governing the introduction of new substances into Canada represent further challenges to the Canadian petrochemicals industry. In the case of CFCs, Canadian producers are responding quickly. For example, Du Pont has converted its CFC facility at Maitland, Ontario, to a hydrochlorofluorocarbon (HCFC) unit. HCFCs are a family of chemicals having between one-fiftieth and one-tenth the ozone depletion potential of CFCs and will be used as medium-term substitutes for them. Such substitutes have been found for many downstream applications, although some sectors, such as refrigeration, still face a number of technical problems in order to eliminate CFC use.

Other regulatory initiatives noted above will alter the demand pattern for certain solvents, generate new techniques for waste disposal and create a notification system to assess the environmental and health impact of chemicals before they enter the Canadian market. New investment by the industry will be required to accommodate these new regulations.

In order to maintain Canadian competitiveness internationally, any changes to Canadian regulatory requirements should try to avoid, as far as possible, imposing a greater economic burden on Canadian industry than is experienced by the industries of major trading partners.

Evolving Environment

The stable supply and pricing of oil and gas feedstocks that existed between 1986 and mid-1990 resulted in a period of strong growth in worldwide petrochemical production. The Canadian industry, which suffered financial losses between 1982 and 1986, operated at close to capacity through early 1989 as a result of strong growth in demand for petrochemicals and their derivatives, and returned to a profitable position. Some of the improvement was provided by the streamlining of operations that occurred throughout the petrochemicals industry in the mid-1980s. The decline in consumption that began in 1989 led to a sharp drop in prices. As a result, many of the expansion plans that were announced in 1988 and 1989, leading to concerns about global overcapacity during the early 1990s, are now being postponed or cancelled.

It is likely that much of the increased petrochemical capacity required in the 1990s will locate, according to traditional patterns, in the established industrialized countries. Energy-rich countries such as Saudi Arabia will attract investment in export-oriented petrochemicals products if they are prepared to offer substantial discounts from international energy price levels. Newly industrialized countries such as the Republic of Korea will participate in the next round of capacity increases, essentially to satisfy their own domestic requirements.

Federal tax reform in Canada has generally moved to reduce rates and broaden the tax bases of corporations. Issues that remain of concern to the petrochemicals industry include a longer capital cost depreciation schedule than that used in the United States and an export tax incentive in the United States, which decreases the effective tax rate for U.S. exporters. There is also a generally higher combined level of federal and provincial corporate taxation in Canada, compared with levels in the United States, the major trading partner.

Evolving environmental regulations worldwide are altering the way companies do business and the products they produce. Consideration of the environmental impact of operations is now being integrated into the day-to-day activities of all industries of the chemical sector, including petrochemicals. A significant portion of current and future capital investment will be designated for the improvement of existing processes and the development of more environmentally acceptable products. All new plants will be subject to rigorous assessments of issues such as the environmental impact of the physical plant on its environs, the safety and containment of raw materials, products and wastes, and the energy efficiency of processes. This creates significant opportunities for the development of new processing technology, remote sensing equipment and handling as well as disposal of hazardous waste.

Competitiveness Assessment

The Canadian petrochemicals industry is profitable and, in spite of being at a competitive disadvantage relative to U.S. Gulf Coast competitors in terms of taxation regimes and construction costs, will further benefit from the removal of tariffs under the FTA. The good strategic location of

Canadian producing regions, compared with the major consuming areas of the United States, namely the northeast and northwest manufacturing zones, leads to advantageous distribution costs for some products. This improves investment prospects for additional facilities in Canada to supply the North American market.

Although not all of the proposed capacity additions are expected to proceed, a number of new plants are planned for Canada. The Dow Chemical ethylene project in Alberta, with associated polyethylene and ethylene glycol (made by Union Carbide) derivative plants, is proceeding. Other ethylene projects are being considered for Sarnia and Montreal. The first Canadian production facility for MTBE (methyl tertiary butyl ether) is scheduled for start-up late in 1991 to meet the quickly growing worldwide demand for this gasoline additive.

For further information concerning the subject matter contained in this profile or in the ISTC sectoral studies (see page 9), contact

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PRINCIPAL STATISTICS[a]

	1982	1983	1984	1985	1986	1987	1988	1989
Establishments	61	57	52	52	52	53	54	54
Employment	15 455	14 653	14 438	14 387	13 962	13 640	13 817	14 561
Shipments ($ millions)	4 434	4 992	5 258	5 220	5 114	6 711	8 021	6 711
(thousands of tonnes)	7 101	8 650	9 370	9 734	8 961	10 518	9 975	9 409
Investment ($ millions)	7 355	7 729	8 326	8 257	8 318	9 269	8 876	8 434
Profits after tax ($ millions)	-129	-124	-132	-520	-173	507	1 362	719
(% of income)	-0.4	-0.3	-2.7	-7.7	-2.6	11.6	22.0	14.6

[a]Data provided by the Canadian Chemical Producers' Association, which represents the producers of more than 90 percent of Canadian output of petrochemicals.

TRADE STATISTICS[a]

	1982	1983	1984	1985	1986	1987	1988	1989
Exports ($ millions)	1 368	1 556	1 645	1 943	1 770	2 605	3 411	3 094
Domestic shipments ($ millions)	3 066	3 436	3 613	3 277	3 344	4 106	4 610	3 617
Imports ($ millions)	1 043	1 475	1 693	1 734	1 852	2 049	2 206	2 282
Canadian market ($ millions)	4 109	4 911	5 306	5 011	5 196	6 155	6 816	5 899
Exports (% of shipments)	30.9	31.2	31.3	37.2	34.6	38.8	42.5	46.1
Imports (% of Canadian market)	25.4	30.0	31.9	34.6	35.6	33.3	32.4	38.7

[a]Data provided by the Canadian Chemical Producers' Association.

SOURCES OF IMPORTS[a] (% of total value)

	1982	1983	1984	1985	1986	1987	1988	1989
United States	76.2	75.7	74.8	71.0	71.4	73.8	72.4	74.3
European Community	16.5	15.0	17.1	19.4	19.1	19.3	16.4	15.6
Japan	1.4	1.4	1.3	1.7	1.9	2.5	2.5	2.1
Other	5.9	7.9	6.8	7.9	7.6	4.4	8.7	8.0

[a]See *Chemicals Directorate Statistical Review*, described on page 9 of this profile.

DESTINATIONS OF EXPORTS[a] (% of total value)

	1982	1983	1984	1985	1986	1987	1988	1989
United States	52.8	56.3	57.8	57.5	56.0	52.7	53.7	55.1
European Community	20.2	15.7	14.0	11.0	12.2	10.3	9.6	12.6
Japan	5.8	8.4	9.5	8.7	7.1	5.8	7.6	8.2
Other	21.2	19.6	18.7	22.8	24.7	31.2	29.1	24.1

[a]See *Chemicals Directorate Statistical Review.*

REGIONAL DISTRIBUTION[a] (average over the period 1986 to 1988)

	Atlantic	Quebec	Ontario	Prairies[b]	British Columbia
Establishments (% of total)	0.5	17.5	60.0	17.8	4.2
Shipments (% of total)	0.5	14.0	58.2	25.4	1.9

[a]ISTC estimates. Accurate data on employment distribution are not available, although they generally approximate the distribution of establishments.
[b]Alberta accounts for almost all Prairie production.

MAJOR FIRMS

Name	Country of ownership	Location of major plants
Dow Chemical Canada Inc.	United States	Fort Saskatchewan, Alberta Sarnia, Ontario
Du Pont Canada Inc.	United States	Maitland, Ontario Sarnia, Ontario
Esso Chemical Canada	United States	Sarnia, Ontario
Novacor Chemicals Ltd.	Canada	Joffre, Alberta Medicine Hat, Alberta Sarnia, Ontario
Pétromont Inc.	Canada	Varennes, Quebec Montreal East, Quebec
Shell Canada Products Ltd.	Netherlands	Scotford, Alberta

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SECTORAL STUDIES AND INITIATIVES

The following studies are available from the Chemicals Directorate (see address on page 6).

Chemicals Directorate Statistical Review
This review is a compilation of selected data on Canada's chemicals-dependent industries from Statistics Canada sources. It provides the statistical indicators (shipments, employment, capital investment and trade data) of industry performance. This issue reflects changes resulting from the adoption of the Harmonized Commodity Description and Coding System (HS).

Chemicals Directorate Statistical Review Supplementary Trade Data
These tables supply commodity trade balances, imports and exports in kilograms and export transaction unit prices.

Petrochemical Industry Task Force Report — February 1984
ISTC sponsored a joint management-labour task force to study the industry in a report prepared for the Ministers of Regional Economic Expansion and of Energy, Mines and Resources.

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