Aluminum Smelting

IC

INDUSTRY PROFILE

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Canada

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INDUSTRY PROFILE

1990–1991

ALUMINUM SMELTING

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

Introduction

Aluminum is one of a group of non-ferrous metals that are smelted and refined in Canada.[1] In addition to *Aluminum Smelting*, industry profiles in this series have been prepared covering

- *Copper Smelting and Refining*
- *Lead and Zinc Smelting and Refining*
- *Nickel Smelting and Refining*

Structure and Performance

Structure

The aluminum smelting industry produces aluminum metal by the electrolysis of molten alumina, which is derived by refining bauxite ore. Approximately 4.5 tonnes of bauxite yield two tonnes of alumina, which in turn provide one tonne of aluminum. Output is in the primary form of billets, sheet and remelt ingots, while a significant tonnage is processed in continuous cast forms. Principal markets for aluminum are the transportation (27 percent), building and construction (20 percent), packaging (20 percent), electrical (7 percent), consumer durables (7 percent), and machinery and equipment (7 percent) industries. The aluminum semi-fabricating sector is covered in a separate industry profile on *Non-Ferrous Semi-Fabricated Metal Products*.

The aluminum smelting sector in Canada consists of two long-established, multinational, integrated companies, Alcan and Canadian Reynolds Metals, and one recent addition, l'Aluminerie de Bécancour (Albecour). Employment in the sector in 1989 was estimated at 12 500 workers and shipments were about $3.8 billion. Alcan is by far the largest producer, with five smelters in Quebec and one in British

[1]See *Standard Industrial Classification, 1980*, Statistics Canada Catalogue No. 12-501, industry group 295. Data on each industry are not collected separately and should be considered only as indicators of trends.

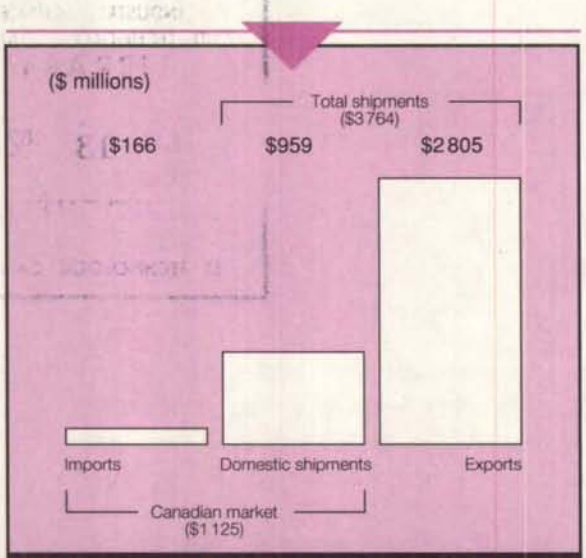

Figure 1 — Imports, Exports and Domestic Shipments, 1989

Columbia having a total capacity of 1.075 million tonnes per year. Canadian Reynolds has a smelter in Baie-Comeau, Quebec, the capacity of which was recently expanded to 272 000 tonnes per year. Albecour has a capacity of 230 000 tonnes per year.

Approximately 75 percent of Canadian aluminum production is exported (Figure 1). The United States is the major customer, taking about 66 percent of total exports, followed by Asian countries with about 18 percent. Canadian exports to Europe are relatively low, primarily because of high tariffs. Imports of primary aluminum into Canada amounted to 15 percent of domestic consumption in 1989 and were mostly from the United States.

In the 1950s, Alcan, like other major aluminum producers, recognized the need to diversify into semi-fabricated products in order to benefit from higher and more predictable profit margins than those available for primary aluminum. Over the years, there has been a gradual decrease in the volume of primary aluminum sold to other parties. Sales of primary aluminum forms now represent 30 percent of total sales.

Alcan exports most of its aluminum to subsidiary semi-fabricating plants in the United States and elsewhere. Canadian Reynolds ships most of its aluminum to Reynolds' plants in the United States for fabrication. Albecour's production is sold on the open market. Both Alcan and Canadian Reynolds operate semi-fabricating facilities in Canada, primarily to supply domestic requirements.

Alcan is also integrated backward into production of alumina and mining of the basic ore, bauxite. Most of its alumina production (and all of the bauxite mining) is carried on outside Canada, primarily in Jamaica, Australia, Guinea and Ireland. Canadian Reynolds and Albecour purchase their alumina requirements from abroad, chiefly from Australia.

Ownership of Alcan is widely held; approximately 50 percent is held by Canadians. Canadian Reynolds is a fully owned subsidiary of Reynolds Metals Inc. of the United States. Albecour is owned 25.05 percent by Pechiney, 25.05 percent by Reynolds Metals, 24.95 percent by Alumax (United States) and 24.95 percent by the Quebec government, the Quebec government's ownership being held by a Crown corporation, La Société générale de financement du Québec (SGF).

In relative terms, Canadian producers' operating costs have been equal to, or lower than, those of other major producing countries. This competitive position of Canadian producers is expected to be maintained as plans for new capacity proceed and as the older style of potlines (the rows of electrolytic cells used in aluminum production) are replaced by the newest cell design.

In 1989, the Western world's primary aluminum capacity amounted to 14.4 million tonnes produced by 114 smelters (see table below).

About 50 percent of this smelting capacity is owned by seven private sector multinational companies (Alcan, Alcoa, Alumax, Alusuisse, Comalco, Kaiser and Reynolds) operating smelters in more than one country; at least to some extent, they are integrated backward to raw materials and forward to finished products. About 30 percent of the Western

Western World Primary Aluminum Capacity, 1989

Area	Number of smelters	Capacity (millions of tonnes)	Share of world capacity (%)
Canada	8	1.6	11.1
United States	23	4.0	27.8
Western Europe	44	3.9	27.1
Asia	14	1.3	9.0
Africa	4	0.6	4.2
Latin America	14	1.6	11.1
Oceania	7	1.4	9.7
Total	114	14.4	100.0

world's smelting capacity is now state-owned, either on a full or partial basis. In aggregate, national governments own about 60 percent of smelter capacity in France, Germany, Norway, Italy and Spain. In past years, there has been an increase in government ownership of smelters, partly because of the nationalization of Pechiney in France, but also because of government involvement in new smelter construction in developing countries.

The former dominance of the multinational aluminum producers is on the decline and their characteristics are changing. Specifically, there is a trend among these large companies away from self-sufficiency in raw materials and primary aluminum towards intensive participation in the more profitable markets for upgraded aluminum products, such as metal composites, semi-fabricated products, foil and finished products. This trend away from self-sufficiency in primary production, which developed in recent years, was in response to excess world capacity created by new entrants and the low prices for bauxite, alumina and primary aluminum.

With minor exceptions, smelters that are fully or partially owned by governments do not enjoy more favourable treatment than those operated by private enterprises. The emergence of many large smelters in the developing countries that are geared to the export of primary metal has had a significant effect on primary aluminum prices. As a result, primary aluminum is increasingly being traded on the open market, mainly through the London Metal Exchange (LME).

Performance

Over the past decade, Canadian smelter capacity has increased by about 45 percent, from an average annual rate of 1.1 million tonnes to 1.6 million tonnes by 1989. Shipments have increased correspondingly. Employment in the smelting industry was about 14 600 workers in 1974, but has since declined to about 12 500 as a result of efforts by the industry to improve productivity. Over this period, productivity rose from 70 tonnes per person-year to 125 tonnes per person-year.

As a result of the 1981–1982 recession, the consumption of refined aluminum in the Western world decreased during that period to about 14 percent below the 1979 level to 10.8 million tonnes, while production also fell to about the same level (Figure 2). Production and consumption quickly recovered to former levels by 1984, then rose further to about 14.5 million tonnes each by 1989.

Detailed financial statistics for the Canadian operations of the aluminum smelting companies are not available, as the companies report their results on a consolidated worldwide basis. Information from industry sources, however, indicates

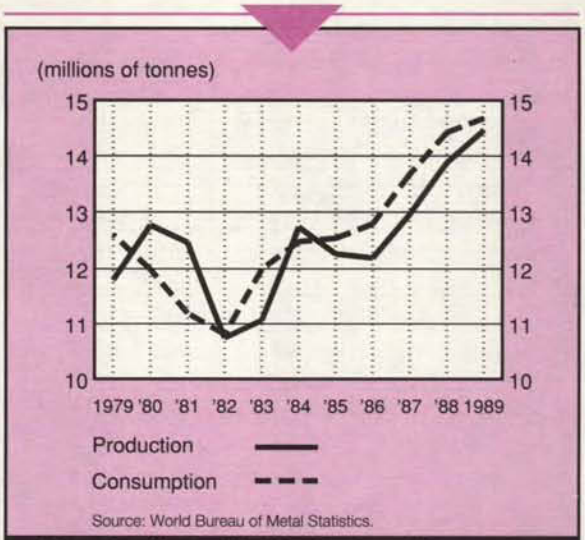

Figure 2 — Western World Production and Consumption of Aluminum

that the industry is fundamentally sound and profitable and that there is every expectation it will remain so in the future.

Canada, notably Quebec, has proven to be an advantageous location for aluminum smelting, attracting new investments. Alcan is proceeding to phase out its Soderberg potlines with new plants employing advanced prebake design technology, which offers productivity and environmental advantages. The Reynolds and Albecour plants are expanding their prebake smelters by 50 percent. Two world-scale smelters (215 000-tonne annual capacity) are being built, one by Alumax and another by an international consortium (Alouette) led by SGF, with start-up in 1992. As a result, Quebec will have a capacity of more than two million tonnes, representing about 12 percent of the expected Western world capacity. Future prospects for new aluminum smelter projects exist in Manitoba and British Columbia.

Strengths and Weaknesses

Structural Factors

Key factors influencing the competitiveness of this sector are access to raw materials, energy costs, capital costs and proximity to markets.

Canada has no domestic sources of bauxite. Bauxite and alumina are therefore obtained from overseas sources, either through related companies or through purchases on the open market.

Aluminum production is highly capital intensive, with present installed smelter costs in excess of $5 000 per tonne of annual capacity, assuming that electrical energy is available. This capital requirement would be at least doubled should a new power installation be required.

Energy costs are the single most important variable cost associated with aluminum production. Therefore, decisions on new smelter projects are based primarily on the assured availability of low-cost energy (generally hydroelectric, flare gas or local, readily exploitable deposits of coal). Many smelters in the United States and Europe that depend on high-cost electricity based on fossil fuel or nuclear energy are becoming uncompetitive. Smelters in France, Germany, Italy and Spain are susceptible to closure by any extended weakness in the price of primary aluminum. Already, Japan's primary aluminum smelting industry has almost ceased to exist because of high energy costs.

Canadian Reynolds and Albecour have long-term energy contracts in place with Hydro-Québec. Alouette Consortium and Alumax have recently entered into similar agreements with Hydro-Québec. Alcan, on the other hand, has traditionally relied on its own generation of electric energy, a policy that has been highly successful in controlling energy costs. Canada has the advantage of its proximity to major markets in the United States, which, in combination with low energy costs and the availability of large blocks of energy, has made it a desirable location for aluminum smelter operations.

Smelters in Australia and Venezuela also have low energy costs, and enjoy the additional benefit of domestic bauxite deposits. As a result, aluminum smelting is continuing to increase rapidly in these countries. Brazil can no longer claim to have cheap power rates, as the current round of smelter expansions is expected to exhaust energy availability.

Since 1984, there has been a dramatic change in the competitive positions of American and European producers. U.S. producers were closing smelters between 1984 and 1986; however, the recent rapid deterioration in the value of the U.S. dollar and the rise in metal prices have resulted in the reactivation of several U.S. smelters. Conversely, the profitability of marginal European smelters is being eroded by the shift in the exchange rate, because about 65 to 70 percent of the cost of producing primary aluminum is paid in local currencies.

Trade-Related Factors

The European Community (EC) accounts for about 30 percent of Western world aluminum consumption and imports about 40 percent of its requirements. While the EC has the highest aluminum tariff at 6 percent, it allows preferential duty-free entry from the European Free Trade Area (EFTA) and General System of Preference (GSP) countries, which account for about 90 percent of its imports, with Norway being the dominant supplier from the EFTA. Except during 1988 and 1989, which were years of high demand, Canada has not really participated in the EC market, concentrating on the duty-free U.S. market (about 70 percent of exports) and the Japanese market (about 20 percent of exports), which has a 1 percent tariff. Should the EC remove tariffs, the price effect could encourage Alcan and Reynolds to increase exports substantially in order to supply their European fabricating operations.

The Canada-U.S. Free Trade Agreement (FTA) has had little direct impact on this sector. Trade in primary aluminum between Canada and the United States was already duty-free. To the extent that the elimination of tariffs on products fabricated from primary aluminum could encourage further upgrading in Canada and could increase exports of such products to the United States, a corresponding reduction in exports of primary aluminum may occur. However, primary aluminum production in Canada is not expected to be affected. The FTA has been strongly endorsed by both the Canadian and the U.S. aluminum industries as being mutually beneficial.

Technological Factors

Both Alcan and Canadian Reynolds have purchased state-of-the-art technology from Alcoa for their latest expansions. Albecour employs the most recent Pechiney (France) technology, as will the new installations of Alumax and Alouette. The current technological developments are aimed at increasing energy efficiency and productivity as well as at reducing pollution.

Other Factors

A concern has been raised that the high concentration of aluminum smelting operations in Quebec could compound the health-related problems associated with fluoride and polycyclic aromatic hydrocarbons (PAHs), which had emissions of about 3 500 and 2 300 tonnes, respectively, in 1989. The major capital investment in smelter modernization being undertaken by Alcan also includes measures to comply with environmental regulations.

Apart from this, there do not appear to be any environmentally related concerns that will affect the competitive position of the industry negatively.

Evolving Environment

Geographical distribution of Western world aluminum consumption in 1989 placed North America first at 38 percent, Europe second at 29 percent, Asia and Pacific at 25 percent, Latin America at 4 percent and the remainder at 4 percent. Both the European and Asian markets are expected to grow at a faster rate than the North American one throughout this decade.

Worldwide annual growth of primary aluminum production over this decade is expected to be 2 to 3 percent. To some extent, the relatively low rate may be attributed to the growing importance of scrap recycling, which amounted to about five million tonnes in 1988, approximating a third of world production. This is expected to increase to 40 percent within the next five years because one unit of recycled aluminum requires only about 5 percent of the energy needed to produce an equal amount of primary metal.

The U.S. containers and packaging industry accounts for about 30 percent of total aluminum demand; more than 80 percent of that demand is met by used beverage cans. The latter are now recycled to the extent of about 60 percent, exceeding 750 000 tonnes a year. Scrap recovery in the United States has developed into an increasingly important activity, as major producers like Alcan compete for an increasing share of this metal source. Secondary aluminum now satisfies more than 30 percent of U.S. requirements.

New, lighter and stronger aluminum-lithium alloys are expected to expand the use of aluminum in aeronautics and aerospace applications. Growing usage of aluminum in automotive applications is expected to save weight, which is especially significant as an energy conservation measure. In the United States, the automakers are legally required to continually increase their corporate average fuel economy (CAFE), which currently is set at 27.5 miles per U.S. gallon (8.5 litres per 100 kilometres). The food can market is being targeted for future growth as development work continues. On the other hand, the development of high-strength plastic composites and thinner, coated steel sheets are threatening aluminum substitution in some structural applications.

As a result of the maturity of the aluminum smelting business, North American aluminum producers are strengthening their business links with manufacturers of aluminum products. Alcan is striving to expand its main business through product development and innovation, focusing its technical, production and marketing resources on products with higher value-added and greater growth and profit potential. Areas that are receiving attention include the can market, foil packaging applications, litho sheets for the printing industry and fin stocks for heat exchangers. Reynolds Metals, a company primarily associated with the development of the aluminum can, continues to promote its use around the world.

Regardless of the impact of the Middle East situation on energy costs, the competitive position of about 40 percent of the U.S. aluminum smelting industry, which purchases power from coal-burning utilities, could be jeopardized by increases in electrical rates brought about by proposed acid rain legislation. In relative terms, the higher U.S. power rates could raise the cost of producing aluminum by about $110 a tonne, as compared to the world average of $264 a tonne. This differential could increase to between $165 and $220 a tonne if various legislative measures designed to reduce acid rain are adopted. The impact of this cost increase could be the permanent closure of a portion of U.S. capacity at the next drop in aluminum prices.

In addition to pending acid rain legislation, the U.S. aluminum industry can be expected to face tougher regulations with regard to hazardous waste disposal and pollution from incineration plants. With a shortage of landfill space, several solid-waste management options are under serious consideration, including source reduction, degradation and reuse, with recycling gaining the strongest public support. There is mounting pressure to legislate enforcement of recycling laws. With a high rate of recycling in effect and with growing markets for secondary material, aluminum is expected to gain greater consumer acceptance as a packaging material, as it is also cheap and convenient.

Energy costs will strongly influence new smelter investment decisions. In the developed world, Canada and Australia are expected to attract investment to increase capacity by about 700 000 tonnes each by 1995. Venezuela should expand production by one million tonnes. Australia and Venezuela also have the advantage of indigenous bauxite deposits. The financially strong governments of the Middle East countries of Bahrain, Qatar, United Arab Emirates and Saudi Arabia are determined to make their region a major aluminum force, increasing combined capacity from 300 000 tonnes to 1.3 million tonnes. Power generation by these latter countries is dependent on by-product gas from oil refining, whereas Venezuela has hydro power available. Brazil has just completed a rapid expansion of its smelting capacity in the past five years, from 550 000 tonnes in 1985 to 950 000 tonnes in 1990. Like Venezuela and Australia, Brazil has benefited

from possessing low-cost power and indigenous bauxite deposits. However, once the current round of expansion to 1.2 million tonnes per year is completed, further expansions in Brazil will be restricted by the exhaustion of low-cost energy.

The EC market is expected to grow at a faster rate than that in North America throughout the decade of the 1990s, surpassing U.S. consumption. Current EC capacity is about one million tonnes below its total demand of 4.5 million tonnes. Increasingly, aluminum producers in Europe are investing outside the EC because of ecological and financial factors, and this trend is fuelling optimism about the eventual removal of the EC tariff.

The evolving political and economic changes in Eastern Europe leads to optimism in the Western business community that aluminum consumption per capita, currently about half that of the EC, will increase dramatically. Potential for future aluminum shipments is good, as it is estimated that Eastern Europe's primary aluminum capacity, at 450 000 tonnes per year, is half its estimated current level of consumption.

The absence of well-established and properly classified statistical data has hampered the analysis and projection of trade on a worldwide basis. In an effort to overcome this obstacle, an agreement was reached at the First International Aluminum Statistical Conference in October 1989 in Tokyo, whereby four major aluminum associations agreed to co-operate. This agreement should result in uniform statistical reporting among about 80 percent of the Western world primary aluminum consumers.

Competitiveness Assessment

With a hydro-electric energy base providing abundant low-cost power and their proximity to the vital U.S. market, Canadian aluminum producers are currently competitive and are expected to remain so. Since aluminum is a widely traded commodity, swings in exchange rates can have significant effects on the profitability of the Canadian industry. While the FTA is not having any significant effect on primary aluminum production in Canada, the industry is expected to benefit from more secure access to the U.S. market.

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PRINCIPAL STATISTICS[a]

	1984	1985	1986	1987	1988	1989
Establishments	7	8	8	8	8	8
Employment	11 500	12 000	12 500	12 500	12 500	12 500
Shipments ($ millions)	2 370	2 346	2 534	2 956	4 008	3 764
(thousands of tonnes)	1 221	1 282	1 355	1 356	1 159	1 554
GDP[b] (constant 1981 $ millions)	1 930	2 069	2 039	2 192	2 345	2 306
Investment[c] ($ millions)	1 049	1 321	987	972	1 344	2 089

[a]ISTC estimates unless otherwise indicated.

[b]See *Gross Domestic Product by Industry*, Statistics Canada Catalogue No. 15-001, monthly. Data relate to total for industry group 295 (non-ferrous metal smelting and refining industries), not specifically to aluminum.

[c]See *Capital and Repair Expenditures, Manufacturing Subindustries, Intentions*, Statistics Canada Catalogue No. 61-214, annual. Data relate to total for industry group 295 and combine capital and repair expenditures.

TRADE STATISTICS[a]

	1984	1985	1986	1987	1988	1989
Exports ($ millions)	1 856	1 636	2 040	2 298	3 068	2 805
Domestic shipments ($ millions)	514	710	494	658	940	959
Imports ($ millions)	85	110	120	102	154	166
Canadian market ($ millions)	599	820	614	760	1 094	1 125
Exports (% of shipments)	78	70	81	78	77	75
Imports (% of Canadian market)	14	13	19	13	14	14
Canadian share of international market (%)	17	18	20	18	15	16

[a]ISTC estimates.

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

	1984	1985	1986	1987	1988	1989
United States	59.0	73.1	78.9	87.3	88.6	91.0
European Community	31.5	21.9	9.5	4.3	2.4	5.2
Asia	–	–	–	1.7	–	–
Other	9.5	5.0	11.6	6.7	9.0	3.8

[a]ISTC estimates.

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

	1984	1985	1986	1987	1988	1989
United States	75.3	65.0	75.5	74.6	70.5	66.3
European Community	3.0	2.2	3.5	2.8	8.1	9.1
Asia	19.9	27.2	16.2	20.9	19.3	17.5
Other	1.8	5.6	4.8	1.6	2.1	7.1

[a]ISTC estimates.

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

	Atlantic	Quebec	Ontario	Prairies	British Columbia
Establishments (% of total)	–	87.5	–	–	12.5
Employment (% of total)	–	86.3	–	–	13.7
Shipments (% of total)	–	82.8	–	–	17.2

[a]ISTC estimates.

MAJOR FIRMS

Name	Country of ownership	Location of major plants
Alcan Smelters and Chemicals Limited	Canada	Alma, Quebec Beauharnois, Quebec Grande Baie, Quebec Jonquière, Quebec Kitimat, British Columbia Shawinigan, Quebec
Aluminerie de Bécancour Inc. (ABI)	United States, 50.00% France, 25.05% Canada, 24.95%	Bécancour, Quebec
Canadian Reynolds Metals Company Limited	United States	Baie-Comeau, Quebec

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