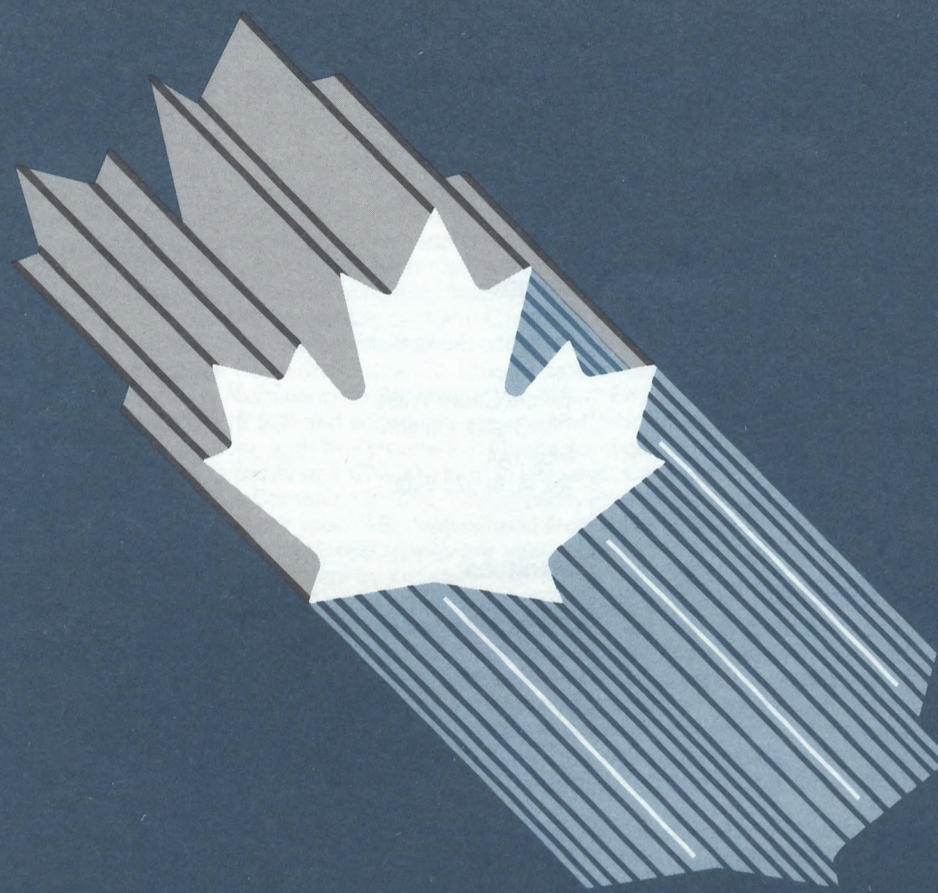
INDUSTRY PROFILE



Industry, Science and Technology Canada
Industrie, Sciences et Technologie Canada

Aluminum Smelting

Canada

Regional Offices

Newfoundland

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

Prince Edward Island

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

Nova Scotia

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

New Brunswick

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

Quebec

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

Ontario

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

Manitoba

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

Saskatchewan

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

Alberta

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

British Columbia

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

Yukon

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

Northwest Territories

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

For additional copies of this profile contact:

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

Tel: (613) 995-5771

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INDUSTRY PROFILE

ALUMINUM SMELTING

1988

FOREWORD

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

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

Robert de Cotret

Minister

Canada

1. Structure and Performance

Structure

This industry sector produces aluminum metal by the electrolysis of molten alumina. The output is in the primary forms of ingots, pigs, billets, slabs and wire bars. Principal users of aluminum are the packaging materials, construction, electrical and transportation equipment industries. The aluminum semi-fabricating sector is covered in a separate Industry Profile on the Non-Ferrous Semi-Fabricating Industry.

The aluminum smelting sector in Canada consists of two long-established, multinational, integrated companies, Alcan Aluminum Ltd. (Alcan) and Canadian Reynolds Metals Co. Ltd. (Canadian Reynolds), and a relative newcomer, l'Aluminerie de Bécancour Inc. (ABI). Employment in the sector is estimated at 12 500 and shipments at over $2.4 billion. Alcan is by far the largest producer, with five smelters in Quebec and one in British Columbia, with a total capacity of 1 075 000 tonnes per year. Canadian Reynolds has a smelter in Baie Comeau, Quebec, with capacity recently expanded to 272 000 tonnes per year. ABI commenced production at Bécancour, Quebec, in 1986 at a rate of 115 000 tonnes per year and reached full capacity of 230 000 tonnes per year by February 1987.

Approximately 80 to 85 percent of the Canadian production of aluminum is exported. The United States is the major customer, taking 65 to 70 percent of the total exports, followed by Asian countries with 20 to 30 percent. Canadian exports to Europe are generally insignificant because of European self-sufficiency and tariffs. Imports of primary aluminum into Canada amount to 10 to 25 percent of domestic consumption and are mostly from the United States. Such imports arise for a variety of reasons, which vary year by year, and are a reflection of competitive market conditions, geographic factors and absence of tariffs.

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. This figure now represents about 35 percent of Alcan's final sales.

Alcan exports most of its aluminum to its own 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, while ABI's production is exported to the open market. Both Alcan and Canadian Reynolds operate semi-fabricating facilities in Canada, primarily to supply domestic requirements.

Alcan is also integrated backwards 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 of Canada. Canadian Reynolds and ABI purchase their alumina requirements from abroad, chiefly from Australia.

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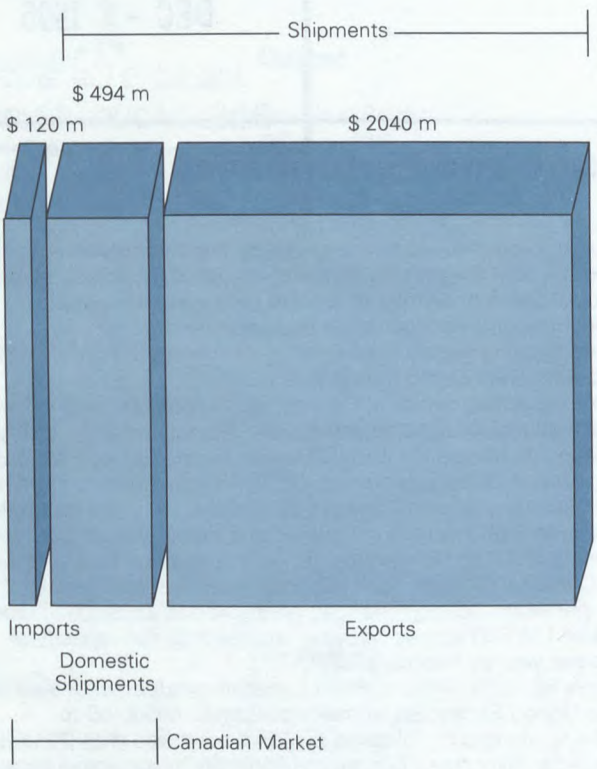


Imports, Exports and Domestic Shipments 1986

Ownership of Alcan is widely held, with approximately 50 percent being Canadian. Canadian Reynolds is a fully owned subsidiary of Reynolds Metals Inc. of the U.S.A. ABI is owned 25.05 percent by Pechiney, 25.05 percent by Reynolds Metals, 24.95 percent by Alumax (U.S./Japan) and 24.95 percent by the Quebec government. The Quebec government's ownership is held by a Crown corporation, Société Générale de Financement du Québec (SGF).

In 1986, western world primary aluminum capacity amounted to 13.61 million tonnes distributed among 115 smelters, as shown below.

WESTERN WORLD PRIMARY ALUMINUM CAPACITY

Area	Number of Smelters	Capacity million tonnes	Percent of World Capacity
Canada	8	1.46	10.7
U.S.A.	25	3.84	28.2
West Europe	44	3.59	26.4
Asia	15	1.26	9.3
Africa	4	.63	4.6
South America	13	1.55	11.4
Oceania	6	1.28	9.4
TOTAL	115	13.61	100.0

About 50 percent of total capacity is owned by seven private-sector multinational companies (Alcan, Alcoa, Kaiser, Reynolds, Alumax, Alusuisse and Comalco) which operate smelters in more than one country and are, at least to some extent, integrated backward to raw materials and forward to finished products. About 28 percent of western world 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, the Federal Republic of Germany, Norway, Italy and Spain. In recent years, there has been an increase in government ownership of smelters, partly because of nationalization of Pechiney in France, but also because of government involvement in new smelter construction in developing countries.

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

With minor exceptions, fully or partially government-owned smelters operate under the same financial incentives and constraints as those operated by private enterprise. The presence of many large smelters in the Third World, which 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 Metals Exchange (LME).

Performance

Canadian smelter capacity over the past decade has increased by about 45 percent, from 1.1 million tonnes per year to 1.6 million tonnes at the end of 1987. Shipments increased correspondingly.

Employment by the smelting industry was about 14 600 in 1974, but has since declined to about 12 500 in 1986 as a result of efforts by the industry to improve productivity. Over this period, productivity rose from 70 tonnes/person-year to 125 tonnes/person-year.

Detailed financial statistics for the Canadian operations of the aluminum smelting companies are not available since the companies report their results on a consolidated worldwide basis. Information from industry sources, however, indicates that the industry is fundamentally sound and profitable, and there is every expectation that it will remain so in the future.

Periodic metal shortages and resulting price surges have been a phenomenon of the primary metal industries and such a period is under way at this time. Typically, such circumstances herald a new round of expansion.

2. Strengths and Weaknesses

Structural Factors

Aluminum metal is produced by the electrolysis of alumina; the latter is derived by refining bauxite ore. Approximately 4.5 tonnes of bauxite yield two tonnes of alumina which, in turn, result in one tonne of aluminum.

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 open market purchases. Currently, supplies are readily available.

Aluminum production is highly capital-intensive, with present installed smelter costs in excess of $4000 per tonne of annual capacity, assuming electrical energy is available. This amount would be at least doubled if new power generation is required.

While alumina is the primary raw material required for aluminum production, electrical energy is the second major input, with carbon anodes for electrolysis constituting a third element of importance. Together, these three elements constitute 65 to 75 percent of the direct cost of aluminum production. Depending on the modernity of the installation, from 13 500 to 18 500 kwh of electrical energy per tonne of aluminum is required for electrolysis.

Energy costs are the single most important variable cost associated with aluminum production, and decisions on new smelter projects are being based primarily on the assured availability of low-cost energy (generally hydroelectric, flare gas or local, readily mineable deposits of coal). Many smelters using high-cost electricity from fossil fuel or nuclear energy in Japan, the United States, and Europe, have either been shut down or have curtailed production. Most significantly, Japan's primary aluminum smelting industry has almost ceased to exist. Closure of smelters in industrialized countries has improved the position of Canada's aluminum industry, which is based entirely on hydro energy, rather than on fossil or nuclear energy.

Europe is essentially self-sufficient from the viewpoint of aluminum supplies. Most of the individual European countries operate state-owned smelters. Norway, which is a signatory of the European Free Trade Agreement, with cheap hydro energy and very large production capacity, generally supplies any deficits that may exist in the rest of Europe. Moreover, Alcan operates wholly or partially owned smelters in the United Kingdom and Spain. Except for some minor ingot exports to the Federal Republic of Germany resulting from Alcan's involvement in that country, there are no significant sales of Canadian aluminum to Europe.

Since 1984 there has been a dramatic realignment in the competitive positions of American and European producers. Whereas U.S. producers were closing smelters in the 1984-1986 period, the recent rapid U.S. dollar devaluation, aided by higher metal prices, has resulted in the reactivation of many U.S. smelters. On the other hand, this currency change has effectively raised the dollar costs of marginal European smelters. Typically, about 65 to 70 percent of the cost of producing primary aluminum is, on average, denominated in local currencies. Smelters in France, the Federal Republic of Germany, Italy and Spain are susceptible to closure by any extended weakness in the price of primary aluminum.

In relative terms, Canadian producers' operating costs have been equal to, or lower than, those of other major producing countries. As planned replacement of older potlines with the newest cell design continues, the competitive position of Canadian producers is expected to be maintained.

Canadian Reynolds and ABI have five-year energy contracts in place with Hydro-Québec; on the basis of excess hydro generating capacity, the agreement was able to provide highly competitive rates. Alcan, on the other hand, has traditionally relied on its own generation of electric energy and this policy also has been highly successful in controlling energy costs. Canada has the advantage of close proximity to the United States which, in combination with moderate energy costs and the availability of large blocks of energy, makes it a desirable location for existing and potential smelter operations.

Smelters in Australia, Brazil 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.

Trade-related Factors

Canadian smelters are well placed for sales to the U.S. market where tariffs on primary aluminum have now been removed entirely. As of January 1, 1988, the Japanese tariff on primary aluminum is one percent and the European Community tariff on primary aluminum is six percent.

A number of elements of the Canada-U.S. Free Trade Agreement (FTA) are relevant to this sector. These include safeguard action provisions and the trade-dispute settlement mechanism. With the increased expansion and growing competition from new aluminum producers in developing countries, more secure access to the U.S. market will benefit Canadian producers.

Technological Factors

Both Alcan and Canadian Reynolds have purchased state-of-the art reduction technology for their latest expansions and ABI employs the most recent Pechiney technology. Most of the current technological developments are aimed at increasing energy efficiency and productivity, as well as reducing pollution.

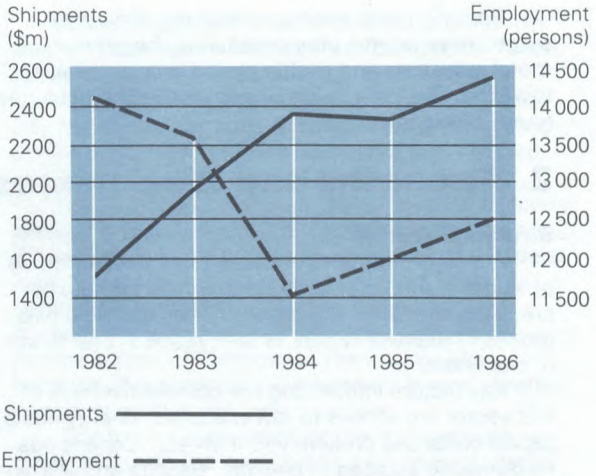
Other Factors

The Canadian government reform of income taxes is not expected to significantly alter the competitive position of Canadian smelters.

3. Evolving Environment

Aluminum has become a mature commodity. Worldwide annual growth of aluminum production over the next decade is expected to be at a modest rate, perhaps in the order of two percent. To some extent, the relatively low rate may be attributed to the growing importance of scrap recycling.

While new uses for aluminum are being developed, significant markets are being lost to plastics and composite materials. In the United States, the growth of aluminum demand for packaging may be peaking. The U.S. packaging industry accounts for about 30 percent of total U.S. aluminum demand, with more than 80 percent of this demand being accounted for by beverage cans. The latter are now recycled to the extent of about 50 percent. Scrap recovery in the United States has developed into an increasingly important factor, and secondary aluminum now satisfies more than 25 percent of U.S. demand.



*Total Shipments and Employment**

** Estimated*

New, lighter aluminum lithium alloys may expand the use of aluminum in aeronautics and aerospace applications, while growing usage of aluminum in automotive applications is expected for reasons of weight savings. However, with the development of high-strength plastic composites, the increases of aluminum usage in some areas may be less than previously anticipated.

Because of maturity of the aluminum smelting business, North American aluminum producers are strengthening their downstream integration and are venturing into non-aluminum businesses. Alcan is expanding into new fields such as advanced materials and new product developments in aerospace, automotive, rail, packaging, electronics and communications through the acquisition of companies with expertise in these fields. In the United States, Alcoa is expanding into many high-technology areas. Reynolds Metals Inc., a company primarily associated with the development of the aluminum can, is placing primary emphasis on seeking to popularize this can around the world. Expansion of its use in Canada can be expected.

The present low cost of alumina, the weaker U.S. dollar and attractive energy pricing arrangements (i.e., linked to aluminum prices) offered by the Bonneville Power Administration in Washington State have resulted in the reopening of previously mothballed smelters in the U.S. northwest. Some of these smelters have been sold to new owners and are now being operated on a tolling basis (user-fee), assisted by wage concessions by the workers.

New smelters will be built in countries with low energy costs. In the developed world, these are Australia, Canada and, to a lesser extent, Norway. Australia may overtake Canada within a decade in the output of primary aluminum because, in addition to shallow coal deposits to provide low-cost energy, it has accessible, high-quality bauxite reserves. In the developing world, the most attractive countries for new smelters are those with both low-cost energy and bauxite, such as Brazil, Venezuela and Indonesia. The key to smelter projects in developing countries in the past has been the development of hydro resources, based largely on financing by the World Bank. With insistence by this institution on greater fiscal responsibility, energy costs in developing countries are rising, and the attractiveness of these countries as smelter locations may diminish somewhat.

Canada is expected to continue to represent an attractive location for aluminum smelting and is likely to attract new smelter investments. Alcan will shortly begin construction of the first phase (100 000 tonnes per year) of a world-scale smelter (200 000 tonnes per year) at Laterrière, Quebec, allowing the gradual phase out of obsolete potlines at the smelter at Jonquière. Also, prospects of expanding ABI's Bécancour facility and of constructing a world-scale aluminum plant (200 000 tonnes per year) elsewhere in Quebec for start-up in 1991-92 are promising. Prospects for new aluminum smelter ventures in Manitoba and British Columbia are less attractive at this juncture.

The FTA will have little direct impact on the sector. Trade in primary aluminum between Canada and the United States is already free. The new provisions concerning safeguard actions and the trade-dispute settlement mechanisms will, however, ensure more secure access. To the extent that the elimination of tariffs on products fabricated from primary aluminum could enhance further upgrading in Canada and increase exports of such products to the United States, some 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.

4. Competitiveness Assessment

With a secure hydroelectric energy base and proximity to the vital U.S. market, Canadian aluminum production is competitive and is expected to remain so. Because aluminum is a widely traded commodity, swings in exchange rates can have significant effects on profitability and competitiveness of the Canadian industry. While the FTA is not expected to have any significant effect on primary aluminum production in Canada, the industry will benefit from more secure access to the U.S. market.

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

Resource Processing Industries Branch
Industry, Science and Technology Canada
Attention: Aluminum Smelting
235 Queen Street
Ottawa, Ontario
K1A 0H5

(613) 954-3123

PRINCIPAL STATISTICS

SIC COVERED: 2951

	1973	1982	1983	1984	1985	1986
Establishments	6	7	7	7	8	8
Employment*	N/A	14 100	13 600	11 500	12 000	12 500
Shipments ($ millions) *	487	1 509	1 975	2 370	2 346	2 534
(volume, '000 tonnes)	1 038	1 065	1 091	1 221	1 282	1 355
Gross domestic product ** (constant 1981 $ millions)	1 390	1 510	1 600	1 995	2 018	2 039
Investment ($ millions)	258	807	745	1 049	1 321	964

TRADE STATISTICS

	1973	1982	1983	1984	1985	1986
Exports ($ millions)	348	1 270	1 654	1 856	1 636	2 040
Domestic shipments ($ millions)	139	239	321	514	710	494
Imports ($ millions)	26	41	55	85	110	120
Canadian market ($ millions)	165	280	376	599	820	614
Exports as % of shipments	71	84	84	78	70	80
Imports as % of domestic market	16	15	15	14	13	19
Canadian share of international market	N/A	19.5	17.0	16.7	18.1	N/A
Source of Imports (% of total value)			U.S.	E.C.	Asia	Others
		1982	85.5	10.2	0	4.3
		1983	69.5	23.2	0	7.3
		1984	59.0	31.5	0	9.5
		1986	78.9	9.5	0	11.6
Destination of Exports (% of total value)			U.S.	E.C.	Asia	Others
		1982	51.9	1.4	42.9	3.8
		1983	65.0	2.1	31.7	1.2
		1984	75.3	3.0	19.9	1.8
		1986	75.5	3.5	16.2	4.8

(continued)

REGIONAL DISTRIBUTION — Average over the last 3 years

	Atlantic	Quebec	Ontario	Prairies	B.C.
Establishments – % of total	0	86.9	0	0	13.1
Employment – % of total	0	86.3	0	0	13.7
Shipments – % of total	0	82.3	0	0	17.7

MAJOR FIRMS

Name	Ownership	Location of Major Plants
1. Alcan Smelters and Chemicals Ltd.	Canadian	Jonquière, Quebec Alma, Quebec Grande Baie, Quebec Shawinigan, Quebec Beauharnois, Quebec Kitimat, B.C.
2. Canadian Reynolds Metals Co. Ltd.	American	Baie Comeau, Quebec
3. Aluminerie de Bécancour Inc. (ABI)	25.05% French 50.00% U.S. 24.95% Canadian	Bécancour, Quebec

* Estimated.
** Relates to total SIC 295 category (Smelting and Refining of Non-Ferrous Metals), not specifically aluminum.