MINERAL POLICY SECTOR

SECTEUR DE LA POLITIQUE MINÉRALE

MINERAL INDUSTRY QUARTERLY REPORT

MARCH 1993

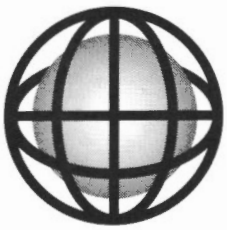
Please do not circulate until

JAN 1, 1994

Ne pas circuler avant

Energy, Mines and Resources Canada
Énergie, Mines et Ressources Canada

Canada



MINERAL POLICY SECTOR

SECTEUR DE LA POLITIQUE MINÉRALE

MINERAL INDUSTRY QUARTERLY REPORT

MARCH 1993

Energy, Mines and Resources Canada
Énergie, Mines et Ressources Canada

Canada

ISSN 1188-9004

Table of Contents

Preface v

Introduction vii

McKnight Appointed New Minister of EMR ix

Notes

Value of Canada's Mineral Production Reached $35.4 Billion in 1992 1

Canadian Mine Openings and Closures, 1988-92: Trends, Impact and Re-Opening Potential 1

Employee Ownership Participation in Canadian Mining and Mineral Manufacturing Firms 2

Map 900A 2

MPS Publications Distribution Office 3

Electronic Distribution of Publications 3

Highlights of Recent Mineral Industry Publications by Statistics Canada 4

Reviews

Mineral Exploration Statistics, 1991 7

Air Quality Challenges in the Production of Primary Iron 17

The Dynamics of Capital Investment in the Mining Industry (Stage 1), 1987-92 25

Statistical Tables

1. Canada, Production of Leading Minerals (September, October) 43

1a. Canada, Production of Leading Minerals (November, December) 44

2. Metal Prices, 1992 45

3. Canada, Real Gross Domestic Product at Factor Cost by Industry, in 1986 Prices, Quarterly 46

4. Canada, Real Gross Domestic Product at Factor Cost by Industries Involved in Mineral Manufacturing, in 1986 Prices, Quarterly 47

5. Mineral Production of Canada, 1990, 1991 and 1992, and Average,1988-92 48

6. Canada, Value of Mineral Production, Per Capita Value of Mineral Production, and Population, 1963-92 49

7. Canada, Value of Mineral Production by Province, Territory and Mineral Class, 1992 50
8. Canada, Value of Mineral Production by Province, Territory and Mineral Class, 1991 51
9. Canada, Value of Mineral Production by Province and Territory, 1986-92 52
10. Canada, Percentage Contribution of Provinces and Territories to Total Value of Mineral Production, 1986-92 53
11. Canada, Production of Leading Minerals, 1991 and 1992 54
12. Value of Leading Minerals in the Provinces, Territories and Canada, 1991 and 1992 55
13. Production of Leading Minerals, by Province and Territory in Canada, 1992 57
14. Production of Leading Minerals, by Province and Territory in Canada, 1991 58
15. Canada, Percentage Contribution of Leading Minerals to Total Value of Mineral Production, 1986-92 59
16. Production of Canada's Ten Leading Mineral Commodities, 1985-92 60
17. Canada, Employment in the Mineral Industry, Stage I – Mineral Extraction and Concentrating (Total Activity), 1961-92 61
18. Canada, Employment in the Nonfuel Mineral Industry, Stage I – Mineral Extraction and Concentrating (Total Activity), 1961-92 62
19. Canada, Employment in the Mineral Industry, Stage II – Smelting and Refining (Total Activity), 1961-92 63
20. Canada, Employment in the Mineral Industry, Stage III – Semi-Fabrication (Total Activity), 1961-92 64
21. Canada, Employment in the Mineral Industry, Stage III – Nonfuel Semi-Fabrication (Total Activity), 1961-92 65
22. Canada, Employment in the Mineral Industry, Stage IV – Metallic Mineral Manufacturing (Total Activity), 1961-92 66
23. Canada, Employment for Services Incidental to Mines, Quarries and Oil Wells, 1961-92 67

Preface

This publication is prepared by the Mineral Policy Sector of Energy, Mines and Resources Canada. Data appearing in this publication are compiled from many sources using the best information available to us. This report is intended to provide the reader with a digest of general information on the status of the mineral industry in Canada. It should not be considered an authority for exact quotation or an expression of the official views of the Government of Canada.

Your comments on the format and contents of this report are welcome. Specific comments can be directed to:

Rob Dunn
Mineral and Metal Statistics Division
Mineral Policy Sector
Energy, Mines and Resources Canada
460 O'Connor Street
Ottawa, Ontario
K1A 0E4

Telephone: (613) 996-6384
Facsimile: (613) 992-5565

Mineral Industry Information Contact Point

In order to provide our clients with timely access to information describing the mineral industry, the Mineral Policy Sector has established a contact point through which requests for specific statistical information on the mineral industry can be channelled. Once a request has been received, it will be immediately directed to the officer most able to address that request.

This contact point is:

Despo Makris
Mineral and Metal Statistics Division
Mineral Policy Sector
Energy, Mines and Resources Canada
460 O'Connor Street, Room 918
Ottawa, Ontario
K1A 0E4

Telephone: (613) 992-6522
Facsimile: (613) 992-5565

Introduction

Recently released data on 1992 mineral production reflect the continuing downturn in the Canadian nonfuel mineral industry. Excluding mineral fuels, the value of mineral production has declined by 4.4% to an estimated $14.6 billion, down by almost $700 million from 1991. Employment data in nonfuel mining also show declines, decreasing steadily from 67 000 in 1989 to an estimated 54 451 in 1992.

Information on exploration levels presented in this issue shows a reduction in exploration activity levels in 1991. Exploration expenditures reached $532 million in 1991, down from the $775 million expended in 1990.

Also featured in this issue is an article on air quality challenges in the production of primary iron in Canada, which discusses the implications and impacts of possible future legislation to limit air emissions.

An analysis of capital investment in the mining industry during the period 1987-92 presented in this issue concludes that "the termination of the Canadian Exploration Incentive Program (CEIP) in 1990, the effects of continuing low metal and flat nonmetal prices, combined with the recession and the lack of exploration success in recent years, have all had an impact on the dynamics of capital investment in the mining sector."

McKnight Appointed New Minister of EMR

On January 4, 1993, Bill McKnight was appointed Minister of Energy, Mines and Resources by Prime Minister Brian Mulroney. He succeeds Jake Epp, who retired from Cabinet.

McKnight, 53, was first elected to the House of Commons in 1979. He has held several portfolios in the Progressive Conservative government since 1984, including Labour, Defence, Indian Affairs and Northern Development and, most recently, Agriculture. A wheat farmer from west-central Saskatchewan, McKnight represents the federal riding of Kindersley-Lloydminster and is the senior Cabinet member for the Province of Saskatchewan.

He was also the first Minister responsible for Western Economic Diversification (WED). Given his involvement with the WED portfolio and his tenure as Labour Minister, it is understood that Mr. McKnight is aware of issues associated with mining and mineral development activities. He also understands the challenges facing the mining industry in northern Canada as a result of his experience as Minister of Indian Affairs and Northern Development.

As the senior federal representative from Saskatchewan, Mr. McKnight is also aware of issues that affect the uranium and potash mining industries, which contribute to the economic strength of his home province.

Mr. McKnight is married to Beverly Rae Ogden and they have two children: a son, Robert Ogden, and a daughter, Torrie Shawn.

Notes

VALUE OF CANADA'S MINERAL PRODUCTION REACHED $35.4 BILLION IN 1992

The total value of Canada's mineral production in 1992 increased by 0.6%, or approximately $200 million above the 1991 level. Preliminary estimates show that the total value of production of all mineral commodities, including mineral fuels, increased from $35.2 billion in 1991 to $35.4 billion in 1992.

Of the four mineral commodity groups (metals, nonmetals, structural materials and fuels), mineral fuels recorded the only increase in overall production value. A gain of approximately $900 million in the total value of mineral fuels production was partly offset by a decline of approximately $700 million in the total value of nonfuel mineral production.

Compared to 1991, the results for individual commodities were mixed, as advances in the value of output of some minerals were offset by losses in others.

Gains in overall production value were led by crude petroleum (+$0.79 billion), zinc (+$0.34 billion) and natural gas (+$0.21 billion). Declines were led by gold (–$0.26 billion), coal (–$0.25 billion) and elemental sulphur (–$0.20 billion).

Excluding mineral fuels, the overall value of production declined from $15.3 billion in 1991 to $14.6 billion in 1992, a decrease of 4.4%. Based on production value, the top commodities in 1992 were: gold ($2.1 billion), copper ($2.1 billion), zinc ($1.7 billion), nickel ($1.7 billion), iron ore ($1.1 billion), and potash ($1.0 billion). Nonfuel minerals accounted for 41.2% of the total value of Canada's mineral production in 1992.

CANADIAN MINE OPENINGS AND CLOSURES, 1988-92: TRENDS, IMPACT AND RE-OPENING POTENTIAL

1992 has shown a continuation of the trend that started in 1990 with mine closures and suspensions far exceeding the mine openings and re-openings recorded over the past three years.

The annual numbers of new mines, re-openings, suspensions and closures in Canada in the 1988-92 period have been published, or are in the process of being published, by the Mineral Policy Sector.

MINING OPERATIONS

	1988	1989	1990	1991	1992	Total
Number of openings and re-openings	26	23	24	18	8	99
Number of closures and suspensions	16	22	26	33	28	125
Net effect on ore production capacity (tonnes/day)	+18 700	+25 600	–30 800	–44 800	–88 000	–119 300
Net effect on direct employment (no. of workers)	+900	+1 850	–1 760	–2 060	–5 800	–6 870
Re-opening potential	12	13	17	19	15	76[a]

SOURCE: Energy, Mines and Resources Canada.
[a] Several mining operations have re-opened or closed in the 1988-92 period.

More detailed information on mine openings and closures may be obtained by contacting the author, Lo-Sun Jen, at (613) 992-0658.

EMPLOYEE OWNERSHIP PARTICIPATION IN CANADIAN MINING AND MINERAL MANUFACTURING FIRMS

This special feature article appears in the March 1993 edition of *Mining Industry Employment Update*.

In recent years, many employees in Canadian mines and mineral manufacturing plants lost well-paying jobs to closures and workforce reductions. Their search for alternative employment often disrupted or uprooted families and frequently led to a reduced standard of living. Those who retained their jobs faced pressures to increase productivity and to reduce real wages for the sake of their firms' competitiveness. Employees, including managers, at some operations in Canada responded by purchasing all or part of their firms to preserve their jobs to maintain their livelihoods and to remain in their communities.

This article examines recent employee ownership participation at five mining and mineral manufacturing firms.

The *Mining Industry Employment Update* is available free of charge. To obtain copies contact the MPS Publications Distribution Office listed below.

For further information contact the author, Nancy Porter, at (613) 995-1507.

MAP 900A

The new edition of Map 900A pinpoints some 240 metallic, nonmetallic and industrial mineral mines, as well as about 200 oil and gas fields. An index provides the name of the

company and the location and principal mineral for each mine and each oil and gas field. Seven inset maps of the country show the locations of nonferrous smelters and refineries, pig iron and ferroalloy plants, mines being developed for production, and major producing areas for minerals such as uranium, gold, silver, tin, nickel, copper, lead, zinc, molybdenum, iron and titanium. Charts provide mineral production statistics by province and territory for fuels and for metallic, nonmetallic and industrial minerals.

Map 900A is available free of charge. To obtain copies contact the MPS Publications Distribution Office listed below.

MPS Publications Distribution Office

The Mineral Policy Sector of EMR prepares a number of information products including regular and special publications, posters and other material. These can be obtained from:

Publications Distribution Office
Mineral Policy Sector
Energy, Mines and Resources Canada
460 O'Connor Street
Ottawa, Ontario
K1A 0E4

Telephone: (613) 992-1108

Electronic Distribution of Publications

The Mineral Policy Sector (MPS) is investigating the electronic distribution of this and other sector publications. If you have access to a link on the Internet and would, at some future date, prefer to receive this publication electronically, then send a message to:

bmccutch@emr.ca

Please state in the body of the message whether you would be interested in receiving this particular publication electronically.

If you have an account on another network (such as CompuServe), you may still be able to receive mail from the Internet. Contact your representative to obtain information on how to send a message to Internet users. You may also wish to enquire about the charges you will incur for receiving publications (such as the charge per kilobyte).

Please remember that we have not yet established a system to distribute information electronically. Your interest will be recorded, however, and will be used in making future publication decisions.

HIGHLIGHTS OF RECENT MINERAL INDUSTRY PUBLICATIONS BY STATISTICS CANADA

Statistics Canada has recently released a publication of interest to the mineral industry. Highlights of this publication follow.

Canada's Mineral Production, Preliminary Estimates – 1992, Catalogue 26-202

Canadian Mineral Production in 1991 and 1992

The total value of output of Canadian mineral production in the four commodity groups of the industry (metallics, nonmetallics, structural materials and fuels) rose from the $35.2 billion recorded in 1991 to $35.4 billion in 1992, an increase of 0.6%.

The total value of metallic mineral production fell to $10.2 billion from $10.5 billion in 1991. Gold and copper continued to be the two leading metals in Canada on the basis of their overall production values, although both metals registered reduced production levels. Zinc strengthened its performance in 1992 with an increase in production and a higher average price over 1991. Nickel production remained essentially unchanged, although nickel prices followed a declining trend due to weak international markets and increased world supply.

Within the nonfuel sector of the mineral industry, the top commodities in terms of the value of production were gold ($2.1 billion), copper ($2.1 billion), zinc ($1.7 billion), nickel ($1.7 billion), iron ore ($1.2 billion) and potash ($1.0 billion).

Ontario contributed the largest share of nonfuel mineral output, accounting for 32.2% of the total value. Quebec followed with 18.0%, British Columbia with 12.7%, Saskatchewan with 8.6% and Manitoba with 7.2%.

To order a Statistics Canada publication, telephone 1-613-951-7277 or use facsimile number 1-613-951-1584. For toll-free, in Canada only, telephone 1-800-267-6677. When ordering by telephone or facsimile, a written confirmation is not required.

Reviews

Mineral Exploration Statistics, 1991

Ginette Bouchard

Telephone: (613) 992-4665

BACKGROUND

Energy, Mines and Resources Canada and Statistics Canada work in cooperation with the provinces to assemble a comprehensive set of annual Canadian exploration statistics.

The final exploration survey results for 1991 are presented in Tables 1 to 10. The preliminary exploration expenditures for 1992 and forecast 1993 expenditures will be available later in 1993. Exploration statistics, and a detailed analysis of the current status of Canadian mineral exploration, appear annually in the *Canadian Minerals Yearbook*. A copy of the most recent yearbook article available can be obtained by contacting the author.

EXPLORATION SURVEY RESULTS

Canadian exploration expenditures for nonfuel minerals, but including uranium and coal, totalled $532 million in 1991, down from $775 million in 1990. Expenditures by senior companies were $416 million, and by junior companies, $116 million. Expenditures on general exploration totalled $465 million while expenditures for on-property exploration (defined as the search for new mines on the properties of existing mines) added the remaining $67 million. In 1991, exploration expenditures declined in all provinces and territories. The most active exploration areas were Quebec ($138.1 million), British Columbia ($135.7 million), and Ontario ($109.7 million).

Exploration expenditures for precious metals (mainly gold) accounted for 52% of total Canadian exploration expenditures, down from 60% in 1990. Exploration expenditures for the base metals (nickel, copper, zinc and lead), increased in percentage terms to 40% of total 1991 exploration expenditures, up from 31% in 1990. However, since Canadian exploration expenditures were considerably lower in 1991 than in 1990, exploration expenditures in dollars for these metals amounted to $213 million in 1991, down from $230 million in 1990.

TABLE 1. GENERAL EXPLORATION PLUS MINESITE EXPLORATION[1] ACTIVITIES BY PROVINCE AND TERRITORY, BY TYPE OF WORK, 1991

Province/Territory	Drilling (Surface and Underground)				Surveys - Other Exploration Work						Total Field Expenditures	Total, Including Overhead[2]
	Diamond		Other				Geophysical			Other Field Costs		
	Metres	Cost	Metres	Cost	Geochemical	Geology	Ground	Airborne	Rock Work			
	(000)	($000)	(000)	($000)	($000)							
Newfoundland	39	2 907	–	75	673	3 797	1 183	41	185	804	9 663	12 065
Nova Scotia	18	853	1	15	298	745	235	2	218	640	3 006	4 532
New Brunswick	70	6 699	–	–	722	2 426	1 003	234	769	1 504	13 358	15 805
Quebec	806	44 481	–	–	3 715	17 197	6 066	1 141	14 218	40 554	127 372	138 108
Ontario	448	36 658	15	801	2 420	19 246	6 128	848	14 155	6 214	86 471	109 683
Manitoba	168	15 973	–	–	587	3 433	3 437	82	1 244	1 485	26 241	29 692
Saskatchewan	127	10 527	10	3 463	1 685	2 406	2 464	303	1 414	3 857	26 119	31 488
Alberta	2	218	125	2 789	294	153	349	–	18	1 239	5 061	6 621
British Columbia	495	38 126	63	3 992	8 105	23 519	8 196	1 169	9 591	10 181	102 878	135 670
Northwest Territories	143	14 858	–	–	465	6 394	2 307	521	76	2 567	27 189	31 624
Yukon Territory	27	3 487	20	1 999	872	2 002	1 066	65	725	1 661	11 877	16 477
Total Canada	2 341	174 789	234	13 133	19 835	81 319	32 434	4 407	42 612	70 706	439 235	531 764

Source: Energy, Mines and Resources Canada, from the Federal-Provincial Survey of Mining and Exploration Companies.
– Nil.
1 Exploration activity includes only the search for new mines; it does not include exploration for extensions to deposits already being mined or committed to production. 2 Overhead expenditures include land costs, field administration costs and exploration-related head office expenses.
Note: Numbers may not add to totals due to rounding.

TABLE 2. GENERAL EXPLORATION PLUS MINESITE EXPLORATION[1] ACTIVITIES BY TYPE OF COMPANY, 1991

Type of Company	Drilling (Surface and Underground)				Surveys - Other Exploration Work						Total Field Expenditures	Total, Including Overhead[2]
	Diamond		Other				Geophysical			Other Field Costs		
	Metres	Cost	Metres	Cost	Geochemical	Geology	Ground	Airborne	Rock Work			
	(000)	($000)	(000)	($000)	($000)							
1. Companies with a producing mine in Canada	1 374	90 739	161	8 243	8 611	38 384	17 453	1 474	24 928	39 067	228 898	268 406
2. Affiliates of group 1	403	37 661	42	2 527	3 299	15 305	6 563	831	5 476	5 181	76 842	98 781
3. Oil companies	49	4 130	–	7	413	841	379	85	58	1 384	7 296	9 883
4. Foreign companies (excluding group 3)	103	7 647	12	359	1 051	6 495	1 466	377	164	5 825	25 384	31 147
5. Junior companies and prospectors	400	33 901	18	1 997	5 875	16 006	6 186	1 246	11 607	18 889	95 706	116 139
6. Other companies	13	712	–	–	587	4 288	387	395	379	361	7 108	7 408

Source: Energy, Mines and Resources Canada, from the Federal-Provincial Survey of Mining and Exploration Companies.
– Nil.
1 Exploration activity includes only the search for new mines; it does not include exploration for extensions to deposits already being mined or committed to production. 2 Overhead expenditures include land costs, field administration costs and exploration-related head office expenses.
Note: Numbers may not add to totals due to rounding.

TABLE 3a. GENERAL EXPLORATION PLUS MINESITE EXPLORATION[1] EXPENDITURES, NOT INCLUDING OVERHEAD,[2] BY PROVINCE AND TERRITORY, BY COMMODITY SOUGHT, 1991

Province/Territory	Metals					Nonmetals	Coal	Commodity Not Specified	Total Field Expenditures
	Base	Precious	Iron	Uranium	Other				
					($000)				
Newfoundland	7 023	1 876	47	42	9	321	–	345	9 663
Nova Scotia	1 603	1 191	–	1	86	125	–	–	3 006
New Brunswick	10 518	2 642	–	–	15	146	36	–	13 358
Quebec	59 519	65 770	171	102	1 028	783	–	–	127 372
Ontario	41 600	43 417	–	–	2	1 381	–	70	86 471
Manitoba	23 027	2 941	–	–	233	40	–	–	26 241
Saskatchewan	4 521	4 208	–	10 498	6	6 568	317	–	26 119
Alberta	51	3	–	134	–	1 827	3 046	–	5 061
British Columbia	29 217	68 470	3	–	1 251	410	2 624	904	102 878
Northwest Territories	4 619	19 400	–	2 830	–	339	–	–	27 189
Yukon Territory	5 784	6 015	–	–	45	1	–	32	11 877
Total Canada	187 482	215 934	221	13 607	2 675	11 942	6 024	1 351	439 235

Source: Energy, Mines and Resources Canada, from the Federal-Provincial Survey of Mining and Exploration Companies.
– Nil.
1 Exploration activity includes only the search for new mines; it does not include exploration for extensions to deposits already being mined or committed to production. 2 Overhead expenditures include land costs, field administration costs and exploration-related head office expenses.
Note: Numbers may not add to totals due to rounding.

TABLE 3b. GENERAL EXPLORATION PLUS MINESITE EXPLORATION[1] EXPENDITURES, INCLUDING OVERHEAD,[2] BY PROVINCE AND TERRITORY, BY COMMODITY SOUGHT, 1991

Province/Territory	Metals					Nonmetals	Coal	Commodity Not Specified	Total, Including Overhead
	Base	Precious	Iron	Uranium	Other				
	($000)								
Newfoundland	8 260	2 754	78	42	60	497	–	375	12 065
Nova Scotia	2 263	2 018	6	1	96	148	–	–	4 532
New Brunswick	12 503	3 015	–	–	26	225	37	–	15 805
Quebec	63 909	71 980	236	102	1 052	829	–	–	138 108
Ontario	45 761	61 974	13	1	24	1 838	–	72	109 683
Manitoba	25 334	3 896	–	–	255	208	–	–	29 692
Saskatchewan	5 185	5 850	–	11 906	6	7 519	1 020	–	31 488
Alberta	51	3	–	201	–	1 980	4 387	–	6 621
British Columbia	35 876	91 216	65	–	1 567	719	3 782	2 445	135 670
Northwest Territories	5 363	21 169	14	3 995	–	1 084	–	–	31 624
Yukon Territory	7 920	8 472	–	–	52	1	–	32	16 477
Total Canada	212 424	272 346	411	16 248	3 138	15 047	9 226	2 923	531 764

Source: Energy, Mines and Resources Canada, from the Federal-Provincial Survey of Mining and Exploration Companies.
– Nil.
1 Exploration activity includes only the search for new mines; it does not include exploration for extensions to deposits already being mined or committed to production. 2 Overhead expenditures include land costs, field administration costs and exploration-related head office expenses.
Note: Numbers may not add to totals due to rounding.

TABLE 4a. GENERAL EXPLORATION PLUS MINESITE EXPLORATION[1] EXPENDITURES, NOT INCLUDING OVERHEAD,[2] BY TYPE OF COMPANY AND BY COMMODITY SOUGHT, 1991

Type of Company	Metals					Nonmetals	Coal	Commodity Not Specified	Total Field Expenditures
	Base	Precious	Iron	Uranium	Other				
	($000)								
1. Companies with a producing mine in Canada	117 070	91 409	47	6 061	635	7 296	5 673	706	228 898
2. Affiliates of group 1	38 076	37 726	–	23	84	65	346	523	76 842
3. Oil companies	929	3 018	–	3 152	8	186	3	–	7 296
4. Foreign companies (excluding group 3)	6 034	10 497	–	3 878	36	2 911	–	28	23 384
5. Junior companies and prospectors	22 012	69 650	173	493	1 913	1 370	2	94	95 706
6. Other companies	3 362	3 635	–	–	–	112	–	–	7 108

Source: Energy, Mines and Resources Canada, from the Federal-Provincial Survey of Mining and Exploration Companies.
– Nil.
1 Exploration activity includes only the search for new mines; it does not include exploration for extensions to deposits already being mined or committed to production.
2 Overhead expenditures include land costs, field administration costs and exploration-related head office expenses.
Note: Numbers may not add to totals due to rounding.

TABLE 4b. GENERAL EXPLORATION PLUS MINESITE EXPLORATION[1] EXPENDITURES, INCLUDING OVERHEAD,[2] BY TYPE OF COMPANY AND BY COMMODITY SOUGHT, 1991

Type of Company	Metals					Nonmetals	Coal	Commodity Not Specified	Total, Including Overhead
	Base	Precious	Iron	Uranium	Other				
	($000)								
1. Companies with a producing mine in Canada	128 843	114 615	158	7 025	692	8 455	7 780	838	268 406
2. Affiliates of group 1	43 159	53 527	–	25	94	66	450	1 459	98 781
3. Oil companies	1 465	3 524	–	3 518	8	427	940	–	9 883
4. Foreign companies (excluding group 3)	7 729	13 834	–	5 153	40	3 928	–	464	31 147
5. Junior companies and prospectors	27 821	83 111	254	528	2 304	1 936	23	162	116 139
6. Other companies	3 407	3 735	–	–	–	234	32	1	7 408

Source: Energy, Mines and Resources Canada, from the Federal-Provincial Survey of Mining and Exploration Companies.
– Nil.
1 Exploration activity includes only the search for new mines; it does not include exploration for extensions to deposits already being mined or committed to production.
2 Overhead expenditures include land costs, field administration costs and exploration-related head office expenses.
Note: Numbers may not add to totals due to rounding.

TABLE 5. GENERAL EXPLORATION PLUS MINESITE EXPLORATION[1]: SURFACE AND UNDERGROUND DRILLING, BY PROVINCE AND TERRITORY, BY COMMODITY SOUGHT, 1991

Province/Territory	Metals					Nonmetals	Coal	Total
	Base	Precious	Iron	Uranium	Other			
	(000 metres)							
Newfoundland	31	7	–	–	–	1	–	39
Nova Scotia	13	3	–	–	1	2	–	19
New Brunswick	52	15	–	–	–	2	–	70
Quebec	265	524	1	–	7	9	–	806
Ontario	207	254	–	–	–	2	–	463
Manitoba	155	11	–	–	2	–	–	168
Saskatchewan	25	20	–	74	–	9	8	137
Alberta	–	–	–	–	–	12	114	127
British Columbia	193	305	–	–	7	3	49	558
Northwest Territories	12	118	–	13	–	–	–	143
Yukon Territory	20	27	–	–	–	–	–	46
Total Canada	973	1 283	1	87	18	41	171	2 575

Source: Energy, Mines and Resources Canada, from the Federal-Provincial Survey of Mining and Exploration Companies.
– Nil.
1 Exploration activity includes only the search for new mines; it does not include exploration for extensions to deposits already being mined or committed to production.
Note: Numbers may not add to totals due to rounding.

TABLE 6. GENERAL EXPLORATION PLUS MINESITE EXPLORATION[1]: SURFACE AND UNDERGROUND DRILLING BY TYPE OF COMPANY AND BY COMMODITY SOUGHT, 1991

Type of Company	Metals					Nonmetals	Coal	Total
	Base	Precious	Iron	Uranium	Other			
	(000 metres)							
1. Companies with a producing mine in Canada	586	723	–	41	5	22	157	1 535
2. Affiliates of group 1	216	214	–	–	1	–	14	445
3. Oil companies	5	21	–	23	–	1	–	49
4. Foreign companies (excluding group 3)	33	48	–	21	–	12	–	114
5. Junior companies and prospectors	127	270	1	2	12	6	–	418
6. Other companies	6	7	–	–	–	–	–	13

Source: Energy, Mines and Resources Canada, from the Federal-Provincial Survey of Mining and Exploration Companies.
– Nil.
1 Exploration activity includes only the search for new mines; it does not include exploration for extensions to deposits already being mined or committed to production.
Note: Numbers may not add to totals due to rounding.

TABLE 7a. GENERAL EXPLORATION PLUS MINESITE EXPLORATION[1] EXPENDITURES, NOT INCLUDING OVERHEAD,[2] BY PROVINCE AND TERRITORY, BY TYPE OF COMPANY, 1991

Province/Territory	(1) Companies With a Producing Mine in Canada	(2) Affiliates of (1)	(3) Oil Companies	(4) Foreign Companies Excluding (3)	(5) Junior Companies and Prospectors	(6) Other Companies	Total Field Expenditures
				($000)			
Newfoundland	3 707	4 467	10	185	1 290	4	9 663
Nova Scotia	1 342	337	–	–	1 317	11	3 006
New Brunswick	6 097	6 207	–	350	694	9	13 358
Quebec	72 462	12 959	836	3 126	31 513	6 477	127 372
Ontario	53 614	18 112	404	4 693	9 430	217	86 471
Manitoba	14 788	10 639	–	40	774	–	26 241
Saskatchewan	18 123	1 900	3 191	1 464	1 427	14	26 119
Alberta	2 863	395	–	1 798	5	–	5 061
British Columbia	38 636	10 921	734	6 538	45 748	300	102 878
Northwest Territories	12 701	7 673	1 341	4 214	1 183	77	27 189
Yukon Territory	4 564	3 231	780	976	2 326	–	11 877
Total Canada	228 898	76 842	7 296	23 384	95 706	7 108	439 235

Source: Energy, Mines and Resources Canada, from the Federal-Provincial Survey of Mining and Exploration Companies.
– Nil.
1 Exploration activity includes only the search for new mines; it does not include exploration for extensions to deposits already being mined or committed to production. 2 Overhead expenditures include land costs, field administration costs and exploration-related head office expenses.
Note: Numbers may not add to totals due to rounding.

TABLE 7b. GENERAL EXPLORATION PLUS MINESITE EXPLORATION[1] EXPENDITURES, INCLUDING OVERHEAD,[2] BY PROVINCE AND TERRITORY, BY TYPE OF COMPANY, 1991

Province/Territory	(1) Companies With a Producing Mine in Canada	(2) Affiliates of (1)	(3) Oil Companies	(4) Foreign Companies Excluding (3)	(5) Junior Companies and Prospectors	(6) Other Companies	Total, Including Overhead
				($000)			
Newfoundland	4 625	5 264	15	240	1 915	4	12 065
Nova Scotia	1 651	416	–	243	2 209	13	4 532
New Brunswick	6 831	7 483	–	560	923	9	15 805
Quebec	77 995	14 764	887	3 838	34 112	6 512	138 108
Ontario	60 606	29 728	475	7 042	11 596	236	109 683
Manitoba	16 916	11 620	–	87	946	123	29 692
Saskatchewan	22 415	2 093	3 559	1 720	1 686	16	31 488
Alberta	4 141	500	41	1 914	26	–	6 621
British Columbia	52 573	14 137	2 122	7 799	58 650	389	135 670
Northwest Territories	14 130	8 267	1 534	6 178	1 410	106	31 624
Yukon Territory	6 522	4 510	1 250	1 528	2 667	–	16 477
Total Canada	268 406	98 781	9 883	31 147	116 139	7 408	531 764

Source: Energy, Mines and Resources Canada, from the Federal-Provincial Survey of Mining and Exploration Companies.
– Nil.
1 Exploration activity includes only the search for new mines; it does not include exploration for extensions to deposits already being mined or committed to production. 2 Overhead expenditures include land costs, field administration costs and exploration-related head office expenses.
Note: Numbers may not add to totals due to rounding.

Air Quality Challenges in the Production of Primary Iron

Robert McInnis

Telephone: (613) 992-8438

There are legitimate public concerns in Canada over the release of potentially health-threatening pollutants from all types of industrial activities. At the same time, Canadians are aware that industries based on abundant natural resources are likely to remain a cornerstone of the domestic economy. The steel industry, for example, accounts for more than 100 000 direct and indirect jobs, and has annual production valued at more than $7 billion. The national challenge is to reconcile the need for sustainable industrial development with the parallel desire for a clean environment in which to live and work.

The competitive status of the steel industry has eroded since the 1960s as a result of many factors. In the 1990s, the industry is not now well positioned to undertake major new investments in alternatives to coke ovens and blast furnaces. The steelmakers are concerned that this international competitive position could be eroded if they are forced to incur costs of major additional environmental constraints not borne by foreign competitors.

The production of primary iron generates a wide range of air emissions such as carbon dioxide, sulphur dioxide and nitrogen oxides; it contributes about 5% of national totals for these common air pollutants, with most coming from the coke ovens and blast furnaces. However, the industry has made substantial progress in mitigating air emissions.

Emissions in Coke Making

Canadian integrated steel producers have significant coke-making capacity. In 1992, there were 780 coke oven cells in operation in Canada with a total capacity of 4.8 Mt. Modern blast furnaces use about 500 kg of coke for each tonne of primary iron produced.

Metallurgical coke is essential to the production of primary iron in a blast furnace. It serves as a reductant, and is the main source of energy in the conversion of iron ore to primary iron. The burning coke generates heat, while maintaining a sturdy porous structure that permits hot gases to flow upward, and molten iron and slag to flow down within the blast furnace.

The coal used to make coke is washed, crushed, screened and blended before being charged into the coke ovens. The individual coke oven cells are constructed of refractory brick and designed to seal tightly so as to provide a controlled oxygen-free environment. The cells are arranged side-by-side in batteries of 45 to 120 ovens. Depending on the blend of coking coals used, there could be up to 30 individual chemical elements or compounds generated during coke making. The coke-making process generates quantities of common pollutants such as CO_2, CO, SO_2, NO_x and particulates that are possible emissions. Because of the number of compounds produced, the coke-making operation is the most problematic in terms of emitting hazardous substances to the environment.

Air emissions may occur at several stages of the coke-making process. For example, the practice of blending several metallurgical coals to yield optimum coke necessitates considerable coal handling. This practice can emit a significant quantity of particulates into the air. The charging of coal into the coke oven cells can release emissions of potentially toxic and flammable gases and dust. The destructive distillation of the coal takes several hours, during which volatile components and moisture are liberated from the coal. Leakage of distillation gases around coke oven doors is an ongoing concern. At the end of the coking cycle, the incandescent coke is discharged into a movable quench car where it is sprayed with water. The quenching produces clouds of water vapour containing some particulate matter.

Emissions from Blast Furnaces

The industry has nine blast furnaces with a production capability of 10 Mt of primary iron. The

blast furnace enables the chemical reduction of iron ore (oxides) to metallic molten iron to proceed according to the following relationship:

- Iron ore (oxides) + carbon (coke) = metallic iron + CO/CO_2 gases + heat.

In addition, calcium and magnesium carbonates (limestone) react with impurities in the coke or iron ore to produce a molten slag.

Air emissions from blast furnaces occur in three principal areas:

Charging of Raw Materials

Coke, iron ore and limestone are charged to the top of the furnace through specially designed hoppers. Because blast furnaces operate continuously under pressure, the charging hoppers must prevent the escape of gases. This is accomplished by compartmentalizing the hoppers with tightly closing doors. Due to the effects of heat and abrasion, the hoppers require regular maintenance to maintain tight seals.

Blast Furnace Gases

The hot gases, consisting of CO_2, CO, H_2, N_2 and minor elements, emerge at the top of the furnace and are cleaned and scrubbed and used as a secondary heat source elsewhere within the plant. Leakage of gases may occur through deterioration of the piping and cleaning equipment; however, the most important emissions are caused when the pressure relief valve opens because of slips of the burden.

Furnace Tapping

Molten iron and slag are tapped from the bottom of the blast furnace. The tapping releases some steam and dust when the molten materials begin to flow along the tapping channels. The gases from the molten iron and slag are collected and condensed, after which the condensate is filtered.

The Future of Coke Making and Blast Furnace Operations

The commercial availability of technological advances in the production of coke and primary iron, which would significantly alter the current processes, is not expected until the early part of the next century. Molten iron can be produced by a number of direct smelting processes. Some, such as the COREX, are commercially proven; others are at the experimental or pilot stage. Major international steel companies have been considering such processes for many years.

Many new technologies reduce or eliminate the need for metallurgical coke, which is often the major advantage they offer to the steel industry. However, operating costs and the reliability are not yet well known. New equipment to produce primary iron is large and expensive. Currently, blast furnaces cost about $250 million and have a projected life of 40 to 50 years. Steel producers are unwilling to risk major investments in new technologies until these have been proven over extended operating periods. It should be noted that blast furnace technology is itself evolving dramatically, and those changes may prolong current blast furnace lives for many years. An example is pulverized coal (PC) injection, where pulverized coal is injected into the blast furnace through the tyers. This coal provides energy and reduction and reduces the amount of coke required in the furnace burden. Coke savings of up to 40% have been achieved in operating furnaces, and the process is now recognized as a proven technology.

Steel Industry Competitiveness

To discuss the ability of the industry to continue to invest in mitigating technologies, it is necessary to look at the competitiveness of the Canadian industry in the context of the domestic and the international steel market. This question brings into focus the issue of harmonizing international environmental regulations so that competition takes place on a level field.

History

In the context of world steel, the Canadian industry is quite young. It became a significant industry during the Second World War, with most of its growth occurring in the post-war years. In the 1950s and early 1960s, industry members were mostly integrated primary producers. The industry planned its growth to match the needs of the domestic market, thus achieving profitably high levels of capacity utilization. Capacity was added when, even in periods of low demand, such as at the bottom of the economic cycle, demand was

greater than industry capacity. In periods of high demand, imports covered the shortfall.

The investment climate at the time encouraged capital investments. There were high expectations and tax benefits in the form of favourable depreciation rates and mineral resource depletion allowances. Companies undertook aggressive capital expenditure programs that resulted in modern facilities with state-of-the-art equipment. The Canadian industry achieved higher productivity levels than many American companies because the U.S. industry did not maintain similar levels of investment. Excess capacity in the United States and a less favourable tax regime were factors in their investment decisions. Canadian companies enjoyed this advantage until the late 1980s when U.S. producers caught up in a massive restructuring. Many U.S. producers now enjoy equal, if not greater, productivity than Canadian producers.

The Canadian steel industry initially benefited from product prices that were higher than those in the United States. A large part of this differential was due to the protected nature of the domestic market. Under pressure from imports, this price advantage declined significantly in the 1960s.

In comparison, the export-oriented U.S. industry had production capacity considerably larger than domestic demand. During the 1960s the United States lost export markets and faced increased competition from imports. These changes resulted in low capacity utilization and declining profits. U.S. government control of prices also contributed to industry losses. Thus, industry profits were not sufficient to fund necessary levels of capital investment for the modernization of plant and equipment. This failure reduced the industry's relative competitiveness even further, with serious consequences. The industry lost virtually all of its export markets, and its domestic market was flooded with imports. Capacity utilization levels and profits plunged even further so that necessary capital expenditures were again put off. The industry simply could not afford them.

By the early 1970s, the United States had become a net importer of steel. Imports of low-priced, often dumped, steel had captured about 30% of the U.S. market. In response, U.S. companies demanded government protection. At industry's request, many investigations for dumping and countervailable subsidies were conducted, and a period of protection under a diverse array of tariff and non-tariff barriers to trade began. Voluntary restraint agreements were still in force in 1991.

Technological change added to the problems faced by the integrated steel companies in both Canada and the United States. Improved electric arc melting furnaces and continuous casting techniques for steel billets fostered the rise of "mini-mills" that melted steel scrap. Rapid growth of this segment of the steelmaking industry altered both the organization and the pricing behaviour of the industry. Today, about 30% of Canadian steel is produced in electric furnaces.

In Canada, the careful control of growth by the steel industry stopped in the early 1970s. Capacity soon exceeded domestic demand forcing companies, especially integrated ones, to seek export sales to maintain rational production levels. The industry was successful in its export efforts, and Canada became a net exporter of steel, mainly to the United States. Today, Canada is still a net exporter but the ratio of exports to imports is much lower.

In the United States, mini-mills were also very successful (approximately 40% of total steel production is from electric furnaces), mostly at the expense of integrated producers. However, mini-mills also gained market shares at the expense of imports. Exporters to North America, especially to the United States, responded by moving their focus to products not made by mini-mills, further increasing competition for the integrated producers. The U.S. industry finally responded to all these pressures with a massive restructuring, often with benefits arising from protection under Chapter 11 of the U.S. bankruptcy legislation. Such Chapter 11 companies are called restructured mills, and they have some significant cost advantages. The recent improvements in U.S. productivity are due to large capital expenditures, more flexibility in job classification, and growth in the electric furnace-based industry.

Some capital improvements were assisted by the formation of joint ventures with offshore steel companies.

Since 1982, U.S. crude steel capacity has dropped by 30% and employment by about 50%. A commonly used measure of productivity is the man-hours required to produce a tonne of steel. In the United States, man-hours per tonne dropped from about 10 to slightly more than 5 in the last 10 years. In comparison, Canadian capacity declined only slightly due to the closure of inefficient or obsolete operations. Man-hours per tonne went from 6.2 in 1971 to 5.4 in 1984, and to 5.1 in 1989. At present, Canadian and American rates are nearly equal.

NORTH AMERICAN STEEL IN THE 1990s

Two Industries

Today's steel industry in both Canada and the United States has evolved into two distinct segments: the integrated producers that make steel mainly from iron ore using blast furnaces and basic oxygen furnaces (BOF); and mini-mill producers that melt ferrous scrap and sometimes direct reduced iron (DRI) using electric arc furnaces.

Although these two industry segments compete with one another, they complement each other in supplying the lowest-cost product to the market, and in the recycling of ferrous scrap. Many grades of scrap contain unwanted impurities called tramp elements. The integrated producer can use lower grades of scrap because tramp elements are diluted by molten blast furnace iron which makes up at least 70% of the charge to the furnace. In addition to dilution, some refining occurs during the oxygen injection in the BOF. For these reasons, integrated producers may sell higher-grade internally generated scrap to the electric steel producers, and purchase lower-cost grades on the open market. Integrated producers may also operate their own electric furnaces to optimize their scrap usage.

Approximately 50% of iron units in North American steel comes from scrap, with a potential to use even more. It should be noted that a high percentage of the metal in steel-intensive products is recycled, a significant contribution to efforts to improve the environment.

The two industry segments have very different requirements for capital and raw materials.

The integrated industry is very capital and labour intensive. Companies are often integrated both forward into manufacturing and backward into the ownership of mines. Canadian integrated steel producers own mines producing iron ore, coal, limestone and other raw materials.

Product mixes at integrated mills are more diverse than those at mini-mills, and often include high value-added products such as cold rolled sheet, coated sheet, drawing-grade steel and tubular products. These products are sold into a much larger geographical area.

The electric furnace industry is much less capital and labour intensive. Its product mix is often limited and may be of lower quality. Mini-mill companies produce products in high demand for relatively local markets, often using scrap from the same geographical area. These companies tend to develop specialized market niches. Much of the efficiency of the mini-mills is credited to the fact that many are non-union shops, with greater flexibility in assigning job responsibilities.

The Markets

Canada and the United States are effectively one market for steel. There have been few barriers to trade in the raw materials consumed in steel production. Many of the iron ore and coal mines in both countries are jointly owned by Canadian and American steel companies. Ferrous scrap and semi-finished steel products are traded freely.

Companies in both countries belong to the same organizations and associations, and they cooperate in research projects.

Under the Canada-U.S. Free Trade Agreement (FTA), the few remaining tariff barriers to trade in steel mill products are being removed. This trade liberation is occurring at a time of fierce competition between the companies in North America. It has dramatically changed the Canadian price structure.

By 1991, price differentials were gone and Canadian companies were selling at prices similar to those in the United States. Those prices were approximately the same as 1984 Canadian prices! Canadian domestic prices were influenced by the increased competitiveness of U.S. producers, the recession and, partly, the FTA. Prices were, in fact, low by U.S. standards, and few U.S. producers were profitable. In 1992, little has changed.

Steel is traded in large volumes and it is difficult to protect steel producers from competition without injuring domestic steel-using industries. All North American companies must be competitive in the world markets, even if they do not export offshore, because they must compete with imports in their domestic markets.

Internationally, many tariff and non-tariff barriers to trade exist. These barriers, together with the effect of fluctuations in relative exchange rates, can be dramatic factors in determining where steel is traded. Many of the barriers are proper under the rules of the General Agreement on Tariffs and Trade (GATT). This is because steel industries in many countries, both developed and developing, are integrated into national policy and even owned by governments. These national industries are

often export-oriented with capacities considerably in excess of domestic demand. Canadian and U.S. authorities have investigated and found many occurrences of dumping and subsidization. Many companies have exported surplus steel at prices close to the variable cost of production, or even lower. In effect, these industries are part of the country's social program, and have less need to maintain profitability. World trade in steel is far from free and fair. Many countries have initiated dumping and countervail actions.

Current Factors in Competitiveness

Efforts to improve or maintain relative competitiveness must address the evolutionary changes in the world industry structure, technology, and markets. They must meet a variety of endogenous and exogenous factors. The following are key areas of activity:

Capital Expenditures

The impacts of increased sophistication of the capital equipment and the processes used by steel producers is a vital consideration in efforts by primary producers to improve competitiveness. In a highly competitive world of fierce competition, prudent decisions in capital spending are crucial. These decisions are complicated by the large size of the financial commitments, the long lead times required for engineering and construction, the rapid development of new technologies, and improvements to existing technologies. The use of the "best" technology is crucial to competitiveness and, conversely, a bad decision can be disastrous.

Many new alternatives to traditional steelmaking processes are at the advanced development stage or at the commercial stage. An example is the "Corex" process, which was developed in Europe and proven by a commercial plant that is operating successfully in South Africa.

Canada's technology decisions have had mixed results. For example, Dofasco Limited installed the first basic oxygen furnace in North America in 1954, a decision that contributed to the company's success. At about the same time, however, Stelco installed what turned out to be the last new open-hearth furnace in North America. That furnace was recently demolished. Open-hearth steelmaking is a technology that proved to be uncompetitive with the BOF. In 1980, Stelco built the newest integrated plant in North America at Nanticoke, Ontario. This plant uses a modern blast furnace, BOF converter and continuous slab casting technologies. It can produce high-quality crude steel at about two man-hours per tonne.

The risk of premature use of new technologies is significant. A coal-based direct reduction plant was built at the Griffith iron ore mine near Red Lake, Ontario. It never operated well or profitably, and has been closed for years. Conversely, some new technologies have been very successful. An example is the Midrex direct reduced iron plant at Longeuil, Quebec, that has operated successfully for almost 20 years.

The Canadian steel industry tends to be conservative, adopting new technologies only when they are well proven. This is a common attitude among world steel producers.

Many of the new technologies are attractive. Total costs (including capital) of primary iron production are said to be quite low. For example, developers claim that some processes are capable of producing molten primary iron for less than $140 per tonne, compared to a low of about $168 per tonne for the best coke oven/blast furnace production. The developers also claim advantages in the costs of complying with environmental legislation. These new technologies could be particularly attractive to electric furnace producers because their minimum economic size is compatible with the requirements of mini-mills. Potential benefits to electric steel plants include fixing some input costs through contractual agreements, and a possible solution to the need for higher-purity raw materials. As noted earlier, the presence of unwanted elements in most steel scrap is a major barrier to increasing mini-mills' market share. Promoters of these new technologies nevertheless face a difficult market. It is likely that more than 10 years will pass before any significant amount of iron will be produced using "new" technologies. It should be noted that blast furnace technology is also evolving with many significant benefits available from such processes as coal injection and oxygen/fuel injection.

The cost of capital (interest rate) is also important, and varies among countries. Industry has pointed out that the cost, and even the availability of money, can be affected by government policies and the actions of the central banks. Canadian interest rates have been maintained at a level roughly 3%-4% higher than U.S. rates in order to attract foreign investment and to maintain the stability of the Canadian dollar. Industry has also noted that higher borrowing costs have put Canadian companies at a disadvantage compared to their U.S. counterparts.

An example of other government influence on borrowing is a recent change in Ontario legislation which passes responsibility for environmental clean-up on to creditors in the event of a business failure. This legislation has made the banks reluctant to lend to companies in the steel industry.

Non-Capital Costs of Production

Raw material quality and costs are a significant factor in the costs of production. In 1988, coal, iron ore and ferrous scrap used in steel production and crude steel purchased for rolling accounted for about 70% of the variable costs of production. North American producers have had neither a cost advantage nor a disadvantage in the world context. The benchmark "Lake Erie" price for iron ore was considerably higher than the world price for many years. However, this was not a true arm's length price because the mines were owned by the steel companies. Coal, which is the primary source of energy in an integrated mill, is priced according to a competitive international market. However, again, much of the coal used in steelmaking comes from company-owned mines, not from arm's length sales. The availability of both coal and iron ore at favourable prices on the world market has meant that the ownership of mines by North American steel companies has not resulted in significant advantages. Similarly, because ferrous scrap is widely traded, prices tend to be internationally uniform.

Labour costs in Canada, at 20% of variable costs in 1988, are an important but slowly decreasing factor in competitiveness. Although wage rates have increased, man-hours per tonne of steel produced have declined. Of perhaps greater importance are the skills and knowledge of the labour force. Also important is a willingness to be flexible in terms of job assignments. Both factors can measurably influence a company's competitive position. In the case of unionized operations, the management and goals of the union play a major part in the way and speed with which companies respond to necessary change.

Management

The preceding sections show that management within the primary steel industry faces enormous challenges. The success or failure of a corporation is largely determined by the quality of management. Management must decide which markets to pursue in the context of competition, both domestic and international. Competitive price, quality and delivery are necessary for success in any market. A company must be competitive, and competitiveness is influenced by decisions on capital equipment expenditures and finance, marketing, and on labour and industrial relations policies.

Management decisions on capital expenditures are particularly important in the steel industry because blast furnaces, coke ovens or rolling mills represent very large capital commitments. Even the rebuilding of an existing blast furnace costs upwards of $120 million. Capital expenditure decisions often embrace the issue of technological change.

Of equal importance is the need to establish and maintain positive labour relations in an industry with strong and effective labour unions. Many steel plant jobs require employees to perform with high levels of skill and attention. Of particular concern in this report is the attention needed for environmental control procedures. Maintenance on coke oven doors and blast furnace charging hoppers is carried out under difficult conditions. Conscientious attention is required by both supervisory and trades personnel. Clearly, positive employee relations are crucial not only to competitiveness, but also to environmental performance.

In an industry with a history of confrontation between management and labour, the creation of good labour and industrial relations will demand strong and perceptive management.

Government

Government environmental and other regulations, and taxation and trade laws, exert a growing influence on Canadian business operations. Good communication and cooperation between industry and governments has become essential. Some observers believe that close cooperation between industry, banks and government in Japan is an important factor in that country's success.

While many will argue for less government interference, the desire of Canadians for an equitable social arrangement, and for the assurance of clean air and water, make reduced government involvement unlikely. The need for international agreements and protocols on diverse issues such as trade and the environment is another factor in the continued involvement of the federal government.

Governments have broad mandates with many responsibilities, and they are lobbied by many and diverse interest groups. Industries cannot ignore

these realities, and they should work to develop and maintain positive and constructive government relations. Many enlightened industry sectors take a pro-active approach by contributing to the pool of information and knowledge on which government regulations are based. Governments know the importance of, and are committed to, consultation with industry on most issues, including environmental protection.

Government-imposed influences on labour costs can produce significant differences in total labour costs among competing countries. In an open market, such as applies to steel, it becomes more difficult to maintain social programs that cost employers significantly more than in competing countries. The need for Canada to have equivalence with the United States is particularly acute because of the FTA.

In a paper presented at the March 1991 air emissions workshop, the President of Stelco stated that it costs his company a total of about $25 an hour for labour. The employee, however, sees only about $13 in cash. An equivalent American company pays about $17 for the same work, but the U.S. employee receives almost $12 in his pay envelope.

Industry is concerned that increased costs of compliance with government-mandated environmental regulations may not be harmonized with Canada's major competitors. Environmental costs are an increasing percentage of total production expenses. For example, one specific Canadian integrated producer has spent over $860 million in capital alone since 1971 to meet environmental requirements. The company estimates that environmental controls currently account for about 3% of production costs for primary iron. A 1991 study[1] by the U.S. Bureau of Mines found that pollution controls added $8-$10 per tonne to the cost of steel. It suggests that the application of the "Maximum Achievable Control Technology," as specified in the 1990 amendments to the *Clean Air Act*, to coke ovens would raise costs at least $15 per tonne.

Economic instruments employed by government could become more significant in the future. Economic instruments use market forces to integrate economic and socially desired goals. To use economic forces to encourage desired behaviour becomes a sort of legislated equivalent of Adam Smith's invisible hand.

An example is a carbon tax proposed by some governments as a means of reducing "greenhouse" gas emissions. The implementation of such a tax could seriously impact on steel industry competitiveness unless adopted uniformly by all steel-producing countries. Business leaders and the public are concerned that the information about the potential long-term changes due to the greenhouse effect is not well known or quantified. A further concern is that the impact of a tax on carbon-consuming industries has not been fully analyzed by proponents of the tax. If a carbon tax of $100/tonne of carbon consumed, as proposed by the European Community's commissioner for the environment, was imposed, the direct impact would be to increase the cost of producing primary iron by $46/tonne. Primary iron now costs about $168/tonne. The tax would also push up the cost of electricity, including that used for pollution control equipment. In Ontario, which obtains about one quarter of its electricity from fossil fuels, overall electricity rates would increase about 13%. Benefits to the environment could be significant, but again, these benefits have not been quantified.

The use of emissions trading to allow market forces to influence the implementation of environmental protection technologies is a definite possibility. The steel industry could benefit from such legislation because it has made dramatic reductions in emissions. The scope of the benefits would depend on the benchmark year chosen. In the same context, the steel industry has an excellent potential to co-generate significant quantities of electricity.

Co-generation could be encouraged if appropriate emissions trading legislation is passed. The generation of electricity could provide some of the funds for the necessary technologies and equipment as well as supplying revenues. A joint venture between Ontario Hydro and a steel company could be of significant benefit to both partners – a good source of non-utility electricity for Ontario Hydro and new lower-cost iron-making equipment for the steel company.

This synergy is possible because of the need to reduce air emissions in coal-fired power generation. Some of the iron and steel-making technologies can easily be seen as clean coal-burning technologies that produce electricity and steel or iron as a by-product or co-product.

Research and development is another area in which the federal government has played a major role. Federal laboratories such as CANMET and the NRC have worked closely with industry on projects

1 *The Effects of the Clean Air Act Amendment of 1990 on the U.S. Coke and Steel Industry and Foreign Trade Balance*, by A.T. Peters, U.S. Bureau of Mines, September 1991.

to benefit industry and, thus, the Canadian economy. The Green Plan states that funds will be made available for demonstration plants for technologies that can contribute to the environmental goals of Canada. Joint industry-government research could assist the industry to improve efficiency and more readily achieve its environmental obligations. Research can develop technologies that help the industry remain internationally competitive, and also be an export product.

Canadian industry has called for a national industry strategy that will spell out Canada's future economic approach, with particular concern for policies on technology, environment and investment. Policy uncertainties create additional risk for capital-intensive industries such as steel. Removal or reduction of the uncertainty would measurably enhance the steel industry's abilities to raise capital and to make the decisions necessary to improve competitiveness.

CONCLUSIONS

1. The steel industry is vital to the industrial economy of Canada. The industry has recently experienced a decline in competitive position, especially relative to its most important trading partner, the United States.

2. Most North American steel producers are operating at a loss. Current volumes of sales at prevailing prices are not profitable. Much of the problem is due to the recession, but some is the result of international structural change. The influence of government economic and fiscal policies in most steel-producing countries has also been significant.

3. The production of primary iron by the integrated steel companies involves processes that can have a significant impact on air quality, with coke ovens and blast furnaces being the most environmentally problematic.

4. The integrated producers have made substantial progress in controlling the emission of common air pollutants, such as sulphur dioxide, nitrogen oxides and particulates. Control of minor but potentially health-threatening air emissions is less comprehensive.

5. The nature of the minor pollutants is known, but data on the amounts released and the threshold limits for health impairment are not internationally established.

6. Alternative technologies that could circumvent the need for coke ovens/blast furnaces are not commercially proven and are unlikely to be significant to Canadian integrated producers for at least 10 years. A high percentage of molten iron will continue to come from blast furnaces for at least 20 years.

7. Present environmental requirements are manageable. However, the integrated producers are unlikely to be able to withstand a significant tightening of environmental requirements not matched by competitor countries.

8. Consideration by governments of additional measures to limit air emissions from the production of primary iron must take into account the cost-effectiveness of the available technologies as well as the adequacy of the measuring and reporting systems, and the firmness of the links between concentrations of pollutants and impacts on human health.

The Dynamics of Capital Investment in the Mining Industry (Stage 1), 1987-92

*This paper was prepared/authored by **Michael McKenzie, Craig Grimes and John Foley**. The authors would like to thank **Réjean Saumure and Olavo Santos** of the Capital Expenditure Section, Investment and Capital Stock Division, Statistics Canada, for their efforts and contribution towards this exercise. Special thanks also to **Greig Birchfield, Robin Dunn and Frank Penton** of Energy, Mines and Resources Canada for their contributions.*

For further information on this subject contact:

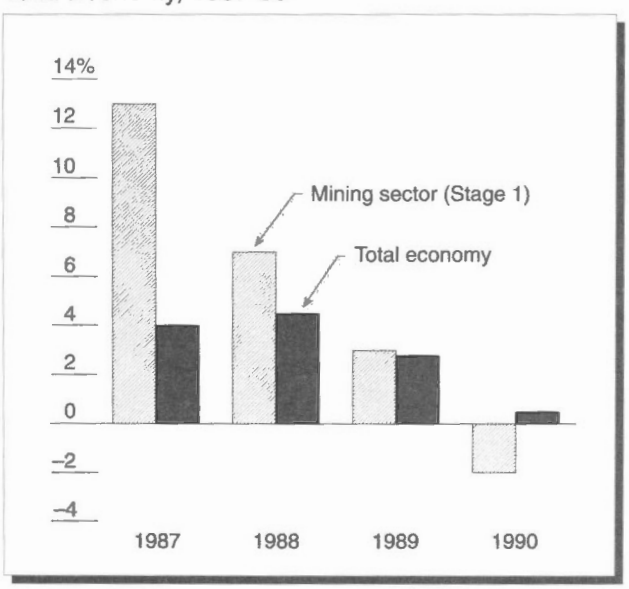
John Foley
Investment and Capital Stock Division
Statistics Canada
Telephone: (613) 951-2591

The total output from the minerals and metal mining industries continues to play an important role in Canada's economy. Between 1986 and 1990, for instance, the total output from the various stages[1] of the minerals and metals industry averaged approximately 5% of GDP. While the growth rates for each stage have varied considerably since 1986, Stage 1 and Stage 2 growth has outpaced the growth rates of the third and fourth stages over the whole period between 1986 and 1990. The real growth rate of the mining sector (Stage 1) outpaced the real rate of growth in the total economy for the years 1987, 1988 and 1989 (see Figure 1). Indeed, mining accounted for approximately 30% ($7.1 billion) of the total value added of the four stages in 1990.

Statistics Canada's Investment and Capital Stock Division (ICSD) has been collecting the capital and repair expenditures along with the expenditures on exploration and development by the mining sector (Stage 1) since the mid-1960s (data published are made available in Catalogue 61-205). In 1987, ICSD introduced a new mining questionnaire for the mining industry survey in order to gather more detailed information. Included in the data it has been collecting is information on the reasons for capital expenditures along with information on the disposal or sales of fixed assets and the reasons for the sale or disposal. To date, this information has not been published publicly.

The purpose of this report is to present an analysis of the information on the mining sector's capital investment and the reasons for capital expenditures, and an analysis of the disposals of fixed assets and the attendant reasons for the sales or disposals of the fixed assets. The analysis examines the behaviour of a selected group of establishments reporting in the sub-industry groups of both the metal and nonmetal mining industry from 1987 to 1990.[2] The number of establishments within each sub-industry group were selected on the basis of continuous response between 1987 and 1990 resulting in a sub-set which constitutes 60% or more of the production activity of their respective industry group.[3] The establishments of the *metal* mining industry's sub-industries range from 67% to 99% of production activity, while the establishments within the *nonmetal* mining industry's sub-industries ranged between 60% and 90% of production activity.

Figure 1
Mining Industry
Real Output Growth Compared to Total Economy, 1987-90



SOURCE: Statistics Canada, CANSIM database.

The exercise is divided into three sections: a review of capital expenditures of the mining industry from 1987 to 1992, an analysis of the panel of respondents, and a brief conclusion.

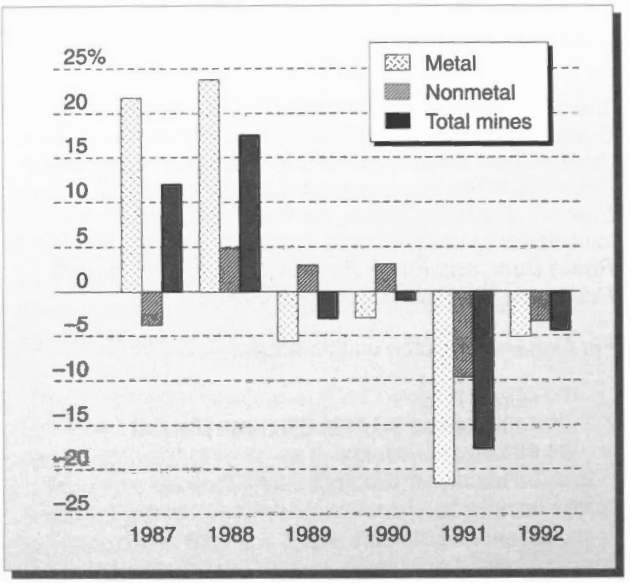
REVIEW OF CAPITAL EXPENDITURES (1987-92)

Total Capital and Repair Expenditures

While capital and repair expenditures on mining were less than 1% of total GDP between 1987 and 1991, in the aggregate, total capital and repair expenditures for the mining sector have risen from almost $4 billion in 1987 to $4.5 billion in 1990, peaking at $4.7 billion in 1988 (see Figure 2). As evident from Figure 2 and illustrated in Figure 3, total capital and repair expenditures have been declining since 1988, decreasing by more than 17% in 1991.

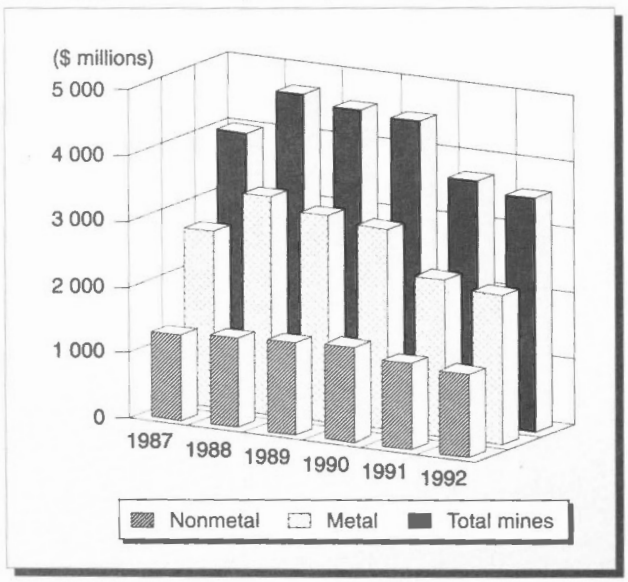
While capital expenditures have been on the decline since 1988, total repair expenditures continued to grow until 1990. Total repair expenditures in 1990 were $2.1 billion, an increase of 6.4% ($124.2 million over the 1989 repair expenditures (Figure 4)).

Figure 3
Mining Industry
Year-Over-Year Rate of Capital and Repair Expenditures, 1987-92



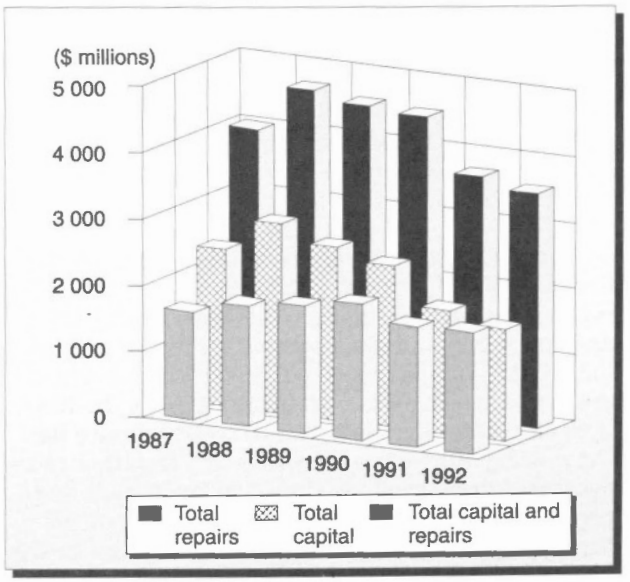
SOURCE: Statistics Canada, ICSD. Actual expenditures for 1987-90, preliminary actual for 1991, and revised intentions for 1992.

Figure 2
Mining Industry
Total Capital and Repair Expenditures, 1987-92



SOURCE: Statistics Canada, ICSD. Actual expenditures for 1987-90, preliminary actual for 1991, and revised intentions for 1992.

Figure 4
Mining Industry
Total Capital and Repair Expenditures, 1987-92



SOURCE: Statistics Canada, ICSD. Actual expenditures for 1987-90, preliminary actual for 1991, and revised intentions for 1992.

Capital Expenditures

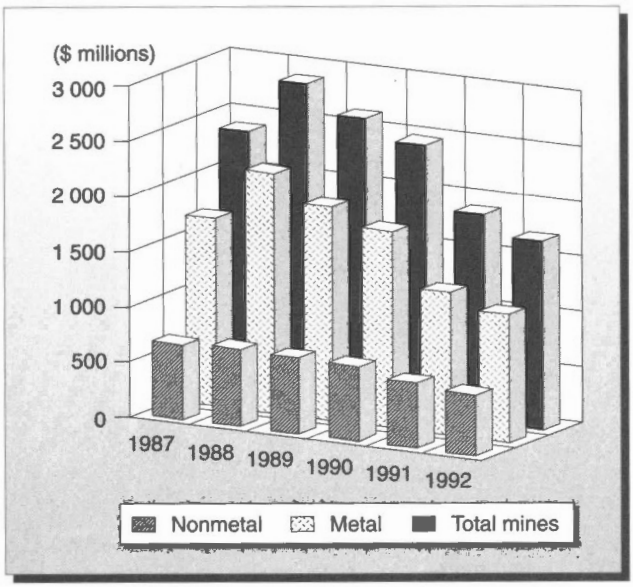
Capital expenditures include the sum total of spending in four distinct components: 1) the acquisition of new machinery and equipment; 2) expenditures for on-property exploration; 3) on-property development; and 4) expenditures for the construction and acquisition of new buildings and other types of surface structures. On-property exploration expenditures include spending on all activities applied to the search for, and delineation of, an additional mineral deposit (i.e., a separate mine) on properties in production or committed to production. On the other hand, on-property development expenditures include outlays for all work done to outline, block out, and gain access to ore and to prepare it for production on properties in production or committed to production.

For the purposes of this report, the first component is defined as capital machinery and equipment. The second, third and fourth components are aggregated to form one single category defined as capital construction. In 1990 for instance, on-property development represented 70.8% of capital construction, on-property exploration represented 6.3% of construction, and structures were 22.9%.

Capital investment in the mining industry peaked at $2.9 billion in 1988 and has continued to decline since 1989 to the present date. Indeed, the forecast for total capital spending in 1992 is $1.8 billion, a drop of $1 billion over three years.[4] The declining trend is the same for both metal and nonmetal mining (see Figure 5).

As Figure 6 demonstrates, the decline in total capital expenditures began with the decrease in construction expenditures in 1989 and continued with decreases in both capital construction and new machinery and equipment spending (see Figure 7). Although machinery and equipment expenditures made a slight rebound in 1992, the downward trend for total capital expenditures was maintained through a further reduction in construction spending.

Figure 5
Mining Industry
Capital Expenditures, 1987-92



SOURCE: Statistics Canada, ICSD. Actual expenditures for 1987-90, preliminary actual for 1991, and revised intentions for 1992.

In addition, this decline in total capital spending corresponded to the decline in flow-through share financing.[5] Flow-through share financing maintained exploration expenditures, and actually increased over the 1983-86 period of falling metal prices. Indeed, the levels of flow-through share financing had increased from $34 million in 1983 to $1.2 billion in 1987. Flow-through share financing fell to approximately $850 million in 1988, $350 million in 1989, and an estimate of $250 million in 1990.

TABLE 1. COMPONENTS OF CAPITAL EXPENDITURES, 1990

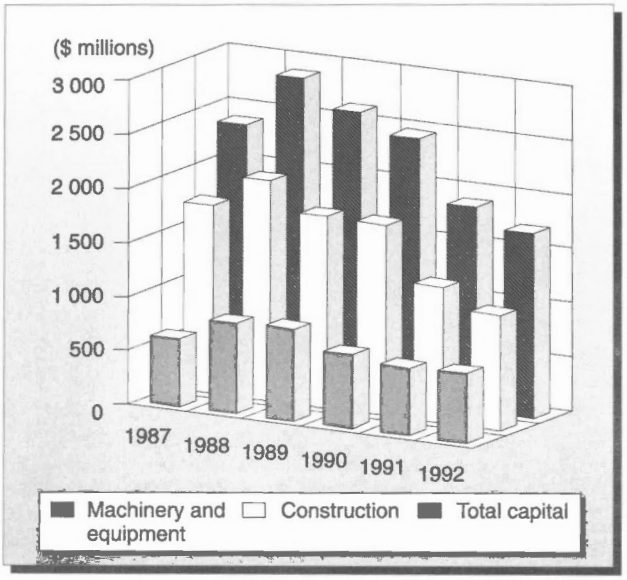
	On-Property Exploration	On-Property Development	Structures	Machinery and Equipment	Total Capital Investment
			($ millions)		
Metal mines	101.8	916.7	340.8	420.6	1 779.4
Nonmetal mines	9.4	335.1	63.8	263.3	671.6
Total mining	111.2	1 251.9	404.1	684.0	2 451.1

Note: Figures may not add to totals due to rounding.

Figure 6

Mining Industry

Machinery and Equipment, Construction, and Total Capital Spending, 1987-92

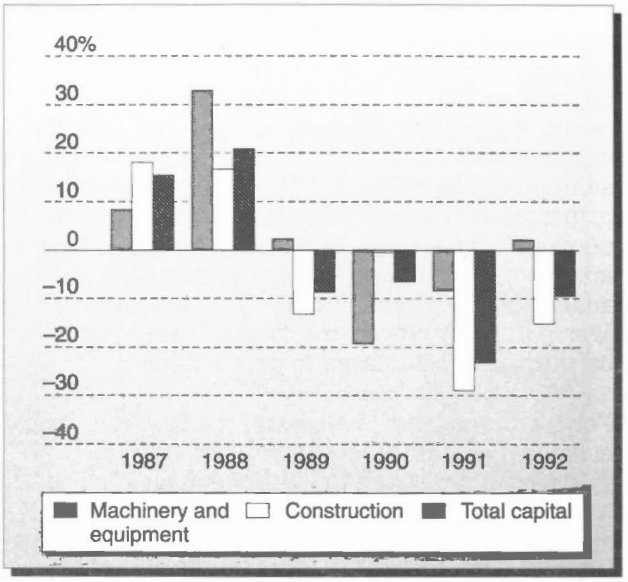


SOURCE: Statistics Canada, ICSD. Actual expenditures for 1987-90, preliminary actual for 1991, and revised intentions for 1992.

Figure 7

Mining Industry

Annual Change in Machinery and Equipment, Construction, and Total Capital Spending, 1987-92



SOURCE: Statistics Canada, ICSD. Actual expenditures for 1987-90, preliminary actual for 1991, and revised intentions for 1992.

The declining trend in construction and machinery and equipment is virtually the same for both metal and nonmetal mining (see Annex 1). In fact, these data show that, while the expenditures on construction began declining in 1989, there is a corresponding lag of one year in decreased demand for new machinery and equipment for both metal and nonmetal mining.

Capital Expenditures by Sub-Industry

Annex 2 summarizes the acquisition of new machinery and equipment, construction, and total capital expenditures along with the year-over-year change in expenditures by sub-industries for both metal and nonmetal mining. The Other Metals sub-industry includes nickel-copper mines, silver-cobalt, and other miscellaneous metal mines. Other Non-Metals, on the other hand, include gypsum mines, salt mines, potash mines, quarries, and sand and gravel pits, along with other miscellaneous nonmetal mines. Some attention will be paid to gold and coal mining since they are the two largest sub-industries of their respective mining industry. In 1988, for instance, the total capital spending by gold mines represented 53% of the total capital expenditures by all metal mines. Similarly, the total capital spending by coal mines represented 47% of the total capital spending by all nonmetal mines in 1988.

Gold Mining

Capital expenditures in gold mining have risen from $516 million in 1986 to $590 million in 1990, reaching a peak of $1.2 billion in 1988 (Annex 2). Since the 1988 high, total capital expenditures for gold continued its slide to the present date, largely as a result of decreased construction spending, especially in the areas of on-property development and on-property exploration. Machinery and equipment expenditures have declined from a high of $292 million in 1988 to $89 million in 1992 (see Figure 8).

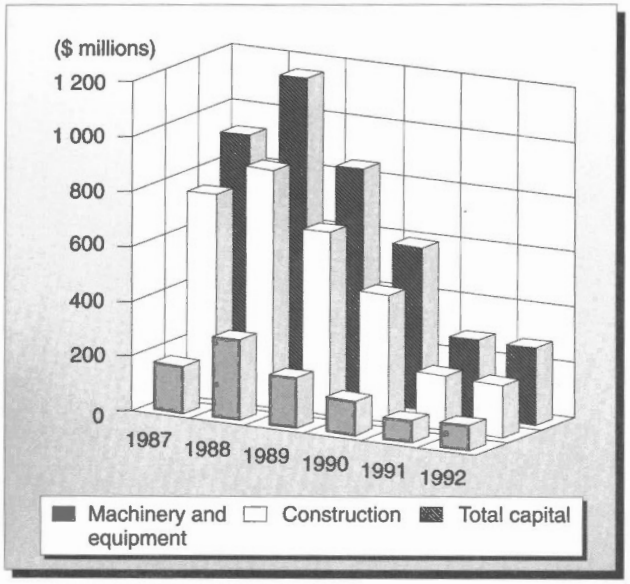
While there has been a reduction in tax and other government incentives for gold exploration during the time period under investigation,[6] low gold prices have also played an important role in influencing capital expenditures in Canada.

As Figure 9 clearly shows, the annual rate of total capital investment follows a similar trend in the annual changes in the commodity price of gold, reflecting a degree of price responsiveness. In fact, low gold prices have been cited as the primary reason

Figure 8

Gold Mining Industry

Machinery and Equipment, Construction, and Total Capital Spending, 1987-92

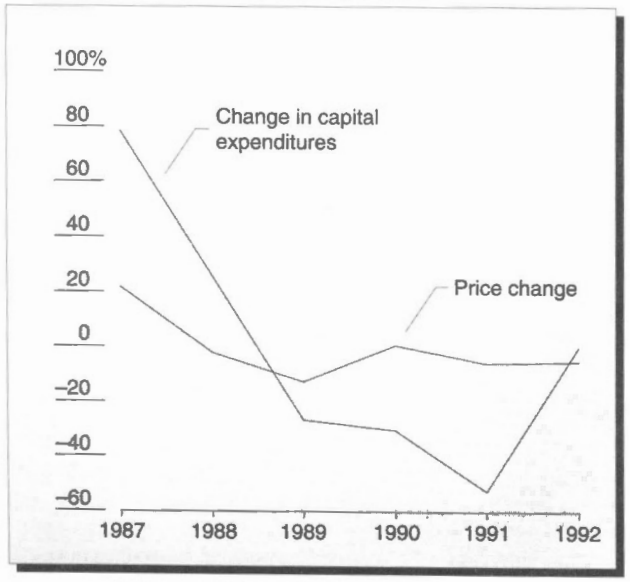


SOURCE: Statistics Canada, ICSD. Actual expenditures for 1987-90, preliminary actual for 1991, and revised intentions for 1992.

Figure 9

Gold Mining Industry

Annual Change in Total Capital Spending versus Annual Change in Commodity Price, 1987-92

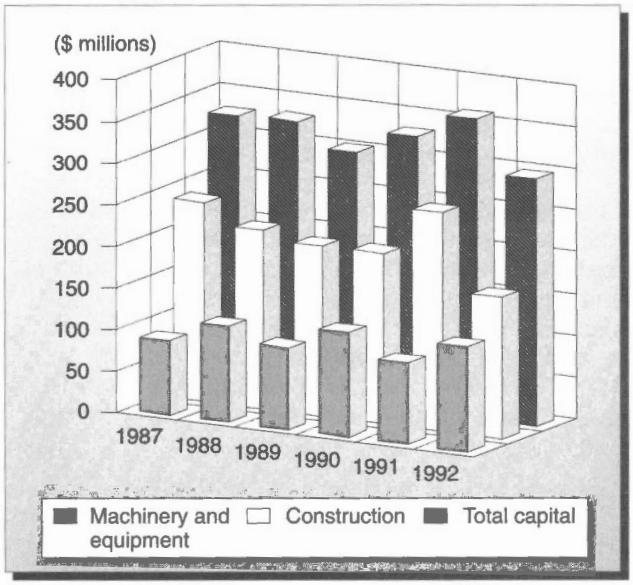


SOURCES: Statistics Canada, ICSD; EMR Canada, Mineral Policy Sector.

Figure 10

Coal Mining Industry

Machinery and Equipment, Construction, and Total Capital Spending, 1987-92



SOURCE: Statistics Canada, ICSD. Actual expenditures for 1987-90, preliminary actual for 1991, and revised intentions for 1992.

for some of the 14 gold mine closures in 1991 rather than the actual depletion of ore reserves.

Coal Mining

Capital expenditures in the coal mining industry in 1987 represented a drop of over $100 million from the previous year (Annex 2). Decreasing construction expenditures and fluctuating machinery and equipment expenditures combined to produce moderate changes in total capital expenditure between 1987 and 1989. On average, total capital expenditure in coal mining has remained relatively stable since 1987 (see Figure 10).

Having reviewed the aggregate capital expenditures, we now focus on some of the specific reasons for capital expenditures, along with the reasons for the disposal/sale of fixed assets on a selected sub-industry basis.

ANALYSIS OF PANEL OF RESPONDENTS

Our analysis of the reasons for capital expenditures and the attendant reasons for the

disposal/sale of fixed assets will focus on a panel of respondents from three sub-industries of metal mining and two sub-industries of the nonmetal mining sector. Under metal mining, we will concentrate on 1) gold mines in detail, 1980 Standard Industrial Classification (SIC 0611); along with references to 2) copper-gold-silver mines (SIC 0612) and; 3) iron mines (SIC 0617). Within the nonmetal mining industry, we will focus on coal mines in some detail (SIC 063), and make lesser reference to potash mining (SIC 0624).

The respondents to the annual survey questionnaire are provided with six categories to explain the reasons for their construction and machinery and equipment expenditures: 1) capacity expansion or new mine; 2) replacement and/or modernization; 3) pollution abatement and control; 4) improvement to working environment (health, safety, security, etc.); 5) reduction of energy costs; and 6) any other major reasons.

The questionnaire also provides the respondents with an opportunity to indicate the selling price of the fixed assets (both construction and machinery and equipment combined), along with six categories to record the reasons for the disposal/sale of the fixed assets. The reasons for disposal/sale are recorded in terms of: 1) the end of the expected useful life; 2) damaged or destroyed assets; 3) outdated technology; 4) energy inefficiency; 5) surplus assets; or 6) any other major reasons.

Gold Mines

Panel's Capital Expenditures

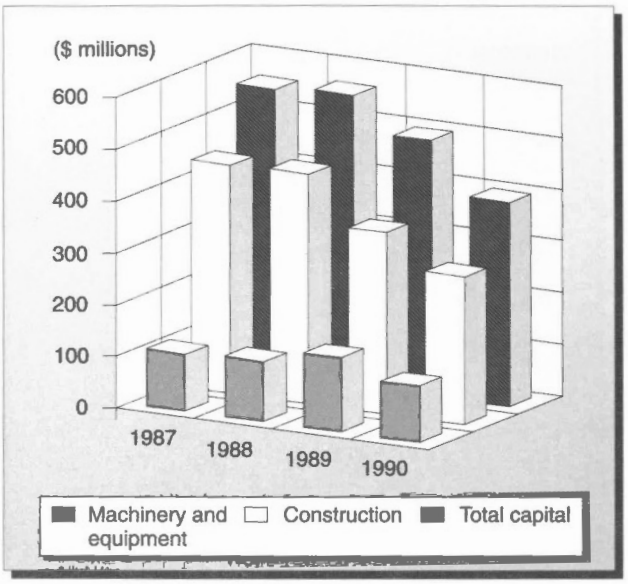
In 1990, the total capital expenditures of the selected respondents represented 67% of the total capital expenditures of the gold mining industry. These same establishments represented 61% of the gold industry's total construction spending and 87% of the new machinery and equipment purchases in 1990. As Figure 11 clearly illustrates, the spending pattern of the panel is very much in line with the overall industry previously shown in Figure 8. Indeed, the capital spending behaviour of the panel of respondents is not only indicative of the overall gold industry's capital spending and price-responsive characteristics shown in Figure 9, but it is also similar to spending characteristics of the entire mining sector pointed out in Figure 7.

Similar to the overall gold industry, the expenditures for on-property development by the panel represent the dominant component of all the components of total capital spending in all four years

Figure 11

Panel of Gold Mining Respondents

Machinery and Equipment, Construction, and Total Capital Spending, 1987-90



SOURCE: Statistics Canada, ICSD. Actual expenditures for 1987-90.

under investigation. For instance, the on-property development expenditures by the panel of respondents rose from $211 million in 1987 to $230 million in 1988, but decreased by $47 million and $7 million respectively in 1989 and 1990 (see Figure 12). In other words, by 1990, the spending to block out and gain access to ore deposits in order to prepare it for production declined by over $50 million from the 1988 level.

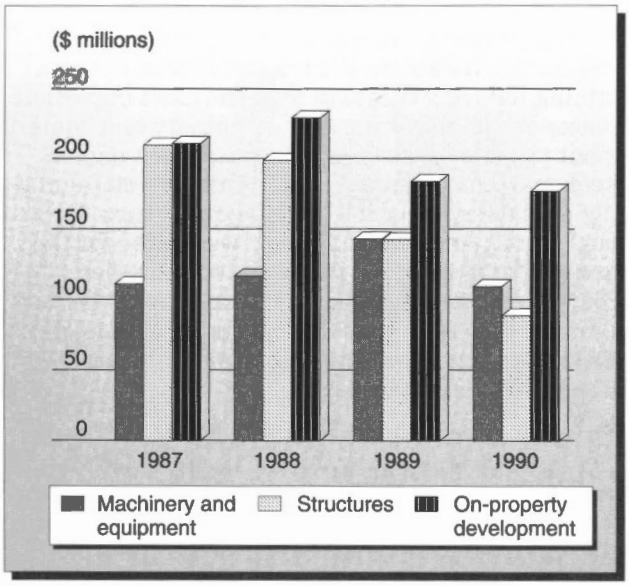
While the expenditures for on-property development exceeded the spending on structures, machinery and equipment, and on-property exploration,[7] Figure 12 illustrates that, after 1988, the spending on machinery and equipment by the panel outpaced that for structures. The spending on structures by the panel in 1990, for instance, was less than half the 1988 level.

Comparing the on-property exploration expenditures of the panel with the panel's spending on general exploration,[8] it was found that expenditures for general exploration tend to be well below those for on-property exploration, with the exception of 1988 (see Figure 13). Figure 13 indicates that, in general, gold producers were spending more money searching for additional deposits on properties already in production or on those committed to production, while spending less searching for ore deposits on sites where no production

Figure 12

Panel of Gold Mining Respondents

Machinery and Equipment, Structures, and On-Property Development Expenditures, 1987-90

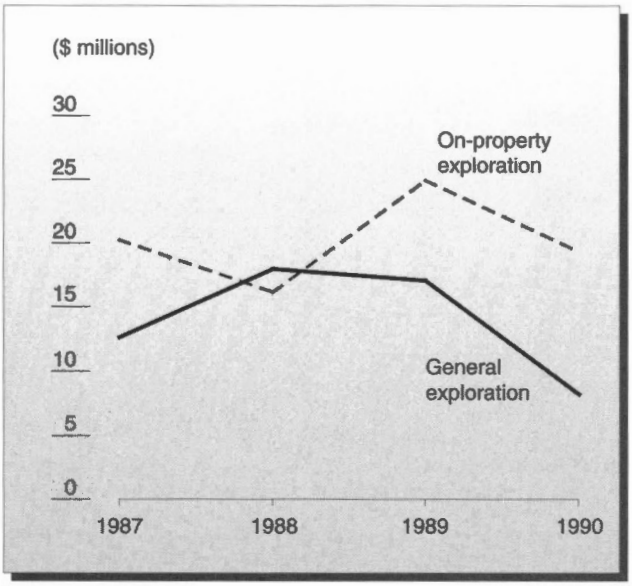


SOURCE: Statistics Canada, ICSD.

Figure 13

Panel of Gold Mining Respondents

General Exploration versus On-Property Exploration Expenditures, 1987-90



SOURCE: Statistics Canada, ICSD.

was taking place. In 1988, however, this trend was reversed by offsetting amounts. As Figure 13 shows, it seems that in 1988 the funds for on-property exploration were substituted towards exploration elsewhere.

Reasons For Capital Expenditures

The reasons for capital expenditures provided by the gold mining panel have not varied considerably between 1987 and 1990. Indeed, the reasons essentially revolve around two of the six categories provided on the questionnaire. The majority of respondents indicated that the main reason for non-residential construction spending between 1986 and 1990 was for the purpose of capacity expansion. Capacity expansion was cited as the reason for over 80% of construction spending in all four years, reaching a high of 93% in 1988. The second important reason cited for non-residential construction expenditures was replacement and/or modernization.

The single most important reason cited for expenditures on machinery and equipment was also that of capacity expansion. Respondents indicated that more than 80% of the money for new machinery and equipment was for the purpose of capacity expansion. The second most important reason for machinery and equipment purchases was that of replacement and/or modernization. In contrast, the least often cited reason for construction and machinery and equipment spending in all four years was the category of improvements to working environment (i.e., category 4).

Sale/Disposal of Fixed Assets

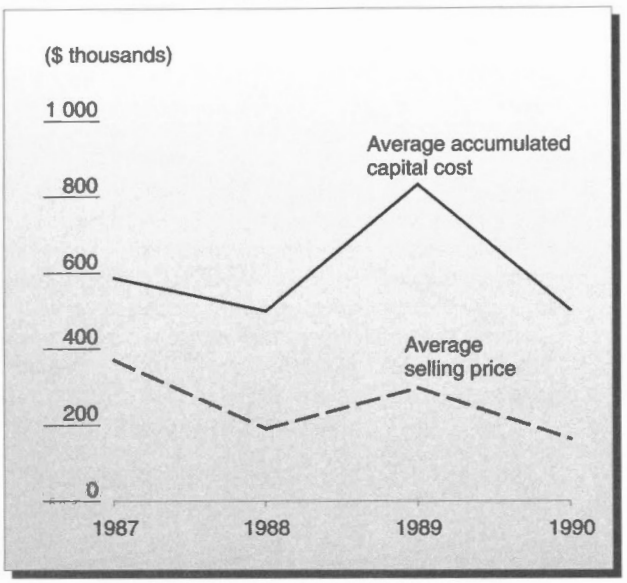
In terms of the sale/disposal of fixed assets, the average selling price of assets ranged from a high of $370 000 in 1987 to a low of $163 000 in 1990, reflecting a decreased demand for capital equipment in the industry as a whole. On the other hand, the average value of the accumulated capital cost[9] of the fixed assets being sold or disposed of ranged from $600 000 in 1987 to $500 000 in 1990, peaking at $800 000 in 1989. The movements in the average value of the accumulated capital cost supports the two most important reasons cited for capital expenditures. Indeed, Figure 14 indicates that the spread between the average selling price and average accumulated capital cost of fixed assets widened as capital spending declined in the overall industry.

With regard to the reasons for the sale or disposal of fixed assets, the two most important reasons cited are: 1) the assets are no longer needed, i.e.,

Figure 14

Panel of Gold Mining Respondents

Average Selling Price and Average Accumulated Capital Cost of Fixed Assets, 1987-90



SOURCE: Statistics Canada, ICSD.

surplus, and 2) the assets have reached the end of their expected useful lives. In contrast, the least cited reason for the sale or disposal of fixed assets was that of energy inefficiency.

Copper-Gold-Silver Mines

The reasons given for capital expenditures in both copper-gold-silver and iron mining parallel those given by the respondents in the gold mining industry. The most important reason given by the respondents of copper-gold-silver mines for undertaking construction and machinery and equipment spending was that of capacity expansion. Respondents indicated that an average of more than 85% of their capital expenditures for construction were for the purpose of capacity expansion between 1986 and 1990. The second reason in terms of importance was that of replacement and/or modernization.

In contrast to gold mining, respondents of the copper-gold-silver industry indicated that the single most important reason for machinery and equipment acquisition was that of replacement and/or modernization of their assets. In all four years, respondents indicated that more than 80% of their machinery and equipment spending was for the purpose of replacement and/or modernization. The above reasons for capital expenditures are further supported by the respondents' explanation that the end of their expected useful life is the primary reason for the disposal or sale of fixed assets.

Iron Mines

In similar fashion to the other two metal mining sub-industries above, the respondents of the iron mining industry point out that the most important reason for undertaking new machinery and equipment purchases was that of replacement and/or modernization. Similar to the other two metal mining industries, over 80% of the expenditures for new machinery and equipment were cited for the purpose of replacement and/or modernization. Indeed, this explanation was backed up by the fact that the only cited reason for disposal or sale of fixed assets was that the assets were no longer needed, i.e., surplus assets.

The only noticeable difference in the capital expenditure behaviour pattern of the three metal mining sub-industries occurred in iron mines' explanation of construction expenditures. While the other two sub-industries cite capacity expansion as their most important reason, followed by replacement and modernization, these two reasons were reversed in the case of iron mines. During the period under investigation, iron mines point out that the major reason for undertaking construction spending was that of modernization (75%), followed by capacity expansion.

Coal Mines

Panel's Capital Expenditures

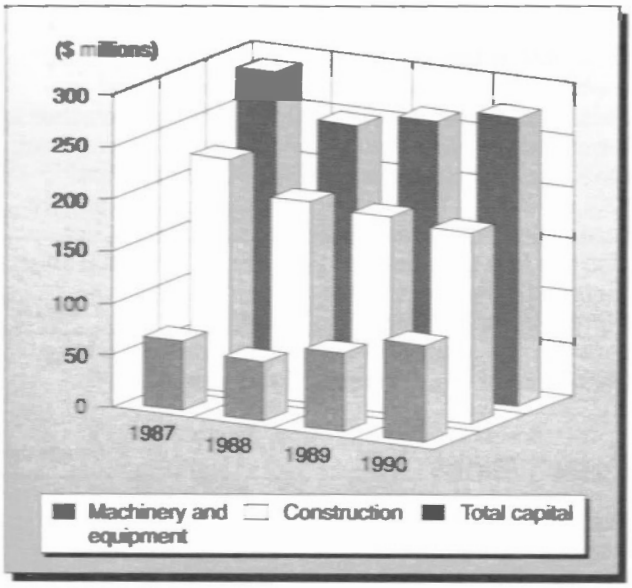
The capital expenditures of the selected respondents of the coal mining industry represented 84% of the capital expenditures by the coal mining industry in 1990. In terms of the construction and machinery and equipment components, these same respondents represented 90% of the capital construction spending and 74% of the machinery and equipment expenditures of the entire industry in 1990. As Figure 15 demonstrates, the spending pattern of the panel for coal mining is very much representative of the whole industry shown in Figure 10.

In terms of the breakdown between all the components of the coal mining panel's capital expenditures, Figure 16 demonstrates that on-property development continues to represent the most significant component of the actual capital expenditures. The on-property development spending in 1990 ($173.1 million) represents a decrease of over $30 million from the 1987 value of $203.1 million. In contrast to the gold mining panel above, the coal

Figure 15

Panel of Coal Mining Respondents

Machinery and Equipment, Construction, and Total Capital Spending, 1987-90

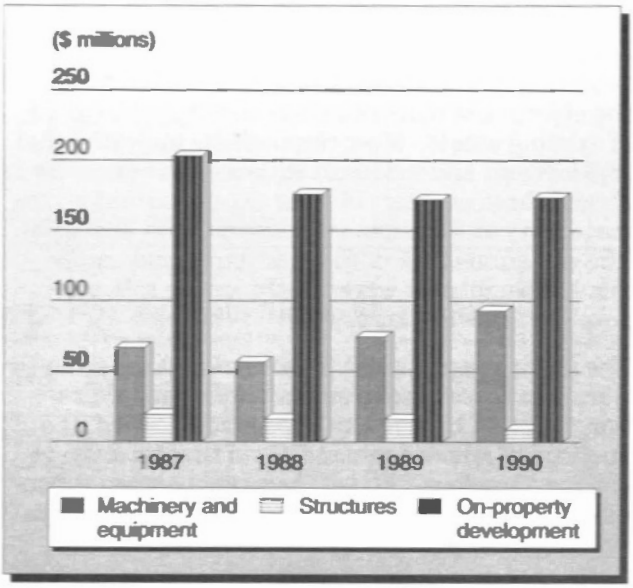


SOURCE: Statistics Canada, ICSD. Actual expenditures for 1987-90.

Figure 16

Panel of Coal Mining Respondents

Machinery and Equipment, Structures, and On-Property Development Expenditures, 1987-90



SOURCE: Statistics Canada, ICSD.

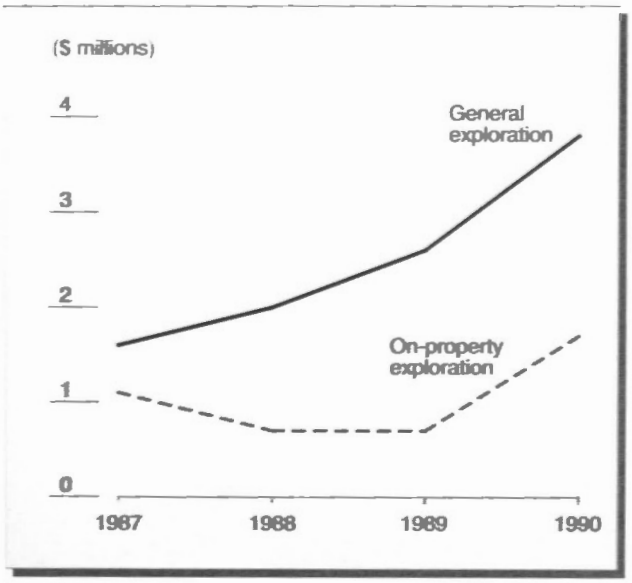
panel showed increased spending on machinery and equipment, with the exception of 1988. The spending on structures, on the other hand, showed no increase over the four-year period (see Figure 16).

A comparison of the on-property exploration expenditures of the panel with their general exploration spending reveals that the coal mining panel's exploration expenditures are completely opposite to that of the gold mining panel. Indeed, while the companies of the gold panel tended to spend more exploring for deposits on properties in production or those committed to production, the coal companies tended to spend more exploring for deposits elsewhere (see Figure 17). While the dollar values are fairly small in relation to the spending on the other three components of total capital, Figure 17 clearly show that there was a steady increase in general exploration by the coal producers in our panel. Spending on general exploration went from $1.6 million in 1987 to $3.8 million in 1990. On the other hand, there was only a marginal increase in the expenditures for on-property exploration in 1990. This spending behaviour was perhaps due to both diminishing returns at sites already in production and the economic need to search elsewhere for cheaper sources as a result of depressed coal prices.

Figure 17

Panel of Coal Mining Respondents

General Exploration versus On-Property Exploration Expenditures, 1987-90



SOURCE: Statistics Canada, ICSD.

Reasons For Capital Expenditures

Much like the reasons given for capital expenditures by the gold industry respondents, the reasons given by the coal industry group are also those of capacity expansion and replacement and/or modernization. The overwhelming majority of respondents point out that the most important reason for acquiring new machinery and equipment was for the objective of modernization and/or replacement of existing assets. Most respondents indicated that replacement and modernization was the cause for almost three quarters of their expenditures for new machinery and equipment between 1987 and 1990. The remaining 25% of the machinery and equipment expenditures were mostly for the sole purpose of expanding capacity.

The major reasons cited for construction spending were also that of replacement and/or modernization, followed by capacity expansion. Indeed, the majority of respondents indicated that an average of more than four fifths of their construction expenditures were designed to replace and/or modernize existing assets.

Sale/Disposal of Fixed Assets

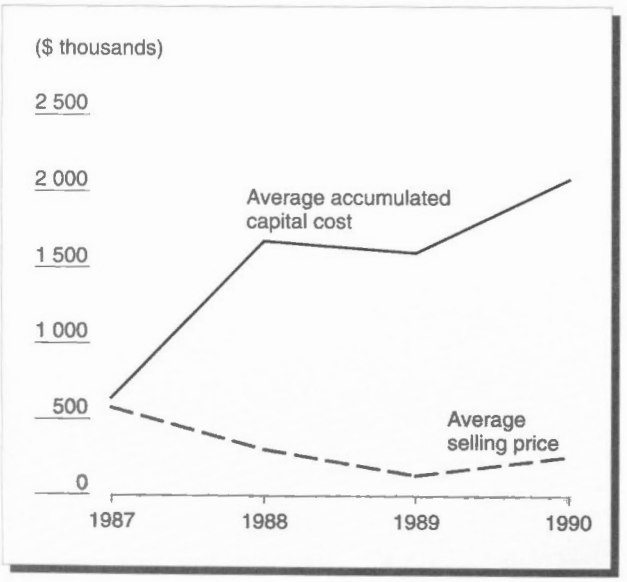
The explanations given for undertaking capital expenditures by the coal mining panel were also supported by the major reason cited for the disposal or sale of fixed assets. The majority indicated that the end of expected useful life of the assets was the major reason for disposal or sale.

The average selling price of fixed assets ranged from a high of almost $600 000 in 1987 to a low of $140 000 in 1989, reflecting low demand for used assets and, to some extent, the financial and production difficulties of the industry.[10] On the other hand, the average accumulated capital cost of fixed assets has increased from $640 000 in 1987 to $2.1 million in 1990, reflecting not only the steady accumulation of machinery and equipment, but also the fact that the companies are not discarding their fixed assets in the short run. Indeed, as Figure 18 shows, there is a pronounced gap between the average selling price and the average accumulated capital cost of fixed assets.

Figure 18

Panel of Coal Mining Respondents

Average Selling Price and Average Accumulated Capital Cost of Fixed Assets, 1987-90



SOURCE: Statistics Canada, ICSD.

Potash Mines

The reasons for capital expenditures given by the respondents from the potash mining industry also parallel those given by the coal mining respondents. Indeed, almost all respondents indicate that the single most important reason for machinery and equipment spending between 1987 and 1990 was for the replacement and/or modernization of existing assets. The potash mining panel indicated that an average of more than 70% of the money spent on machinery and equipment was for the purpose of replacement and modernization. The remainder was spent mainly for the purpose of capacity expansion. The major reason cited for construction spending was split between that of capacity expansion and replacement and/or modernization.

The most significant reason assigned for the disposal or sale of fixed assets by potash mines was that the assets had reached the end of their expected useful lives. The panel indicated that about 70% of the cause for sale or disposal was due to assets reaching the end of their useful service lives, whereas the remaining 30% was primarily due to outdated technology.

Summary

The categories regarding the reasons for capital expenditures are shown separately in Table 2, whereas the categories for the reasons for the sale/disposal of fixed assets are illustrated in Table 3. A summary of the reasons given by each subindustry towards the questions asked in Table 2 and Table 3 is provided in Tables 4 and 5.

TABLE 2. MAJOR QUESTIONS ASKED ON SURVEY QUESTIONNAIRE FOR CAPITAL EXPENDITURE

(1) Capacity Expansion of New Mine
(2) Replacement and/or Modernization
(3) Pollution Abatement and Control
(4) Improvements to Working Environment
(5) Reduction of Energy Costs
(6) Any Other Major Reasons

TABLE 3. MAJOR QUESTIONS ASKED ON SURVEY QUESTIONNAIRE REGARDING DISPOSAL OR SALE OF FIXED ASSETS

(1) End of Expected Useful Life
(2) Damaged or Destroyed Assets
(3) Outdated Technology
(4) Energy Inefficiency
(5) Assets No Longer Required (Surplus)
(6) Any Other Major Reasons

TABLE 4. CAPITAL EXPENDITURE[1] BY MAJOR REASONS FOR EXPENDITURE AND BY INDUSTRY

	Reason for Machinery and Equipment Expenditure		Reason for Construction Expenditure	
Industry	Capacity Expansion	Replacement/ Modernization	Capacity Expansion	Replacement/ Modernization
	(percent)			
Gold	80	10	80	10
Copper-gold-silver	15	80	85	15
Iron	15	80	10	75
Coal	25	75	15	80
Potash	30	70	50	50

[1] As a percentage of total capital expenditure on machinery and equipment and as a percentage of total capital expenditure on construction. Figures represent the four-year average percentage of spending on machinery and equipment and construction for the majority of respondents in each mining panel.

TABLE 5. MAJOR REASON FOR DISPOSAL/SALE OF FIXED ASSETS

Industry	
Gold	End of expected useful life
Copper-gold-silver	End of expected useful life
Iron	Surplus assets
Coal	End of expected useful life
Potash	End of expected useful life

CONCLUSIONS

The reasons given by the five mining sub-industries for undertaking capital expenditures between 1987 and 1990 essentially revolve around either the purpose of expanding capacity, ie., new mining activity, or the goal of replacing and/or modernizing existing assets. At the same time, the most significant reason supplied for disposal or sale of fixed assets was that the assets had either reached the end of their expected useful lives or that the fixed assets had indeed become surplus assets.

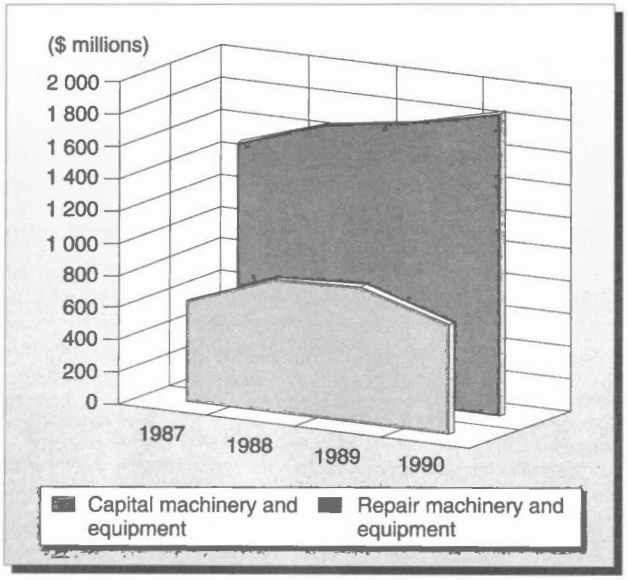
On the other hand, while the expenditures on total capital decreased, total repair expenditures continued to steadily increase. Indeed, as the expenditures on new machinery and equipment decreased, there is a comparatively upward trend in the dollars spent on repairing existing machinery and equipment (see Figure 19). The large spread between the dollars spent on new acquisitions and on repair is both a function of the cost of repairing and maintaining older stocks along with the cost of maintaining recent acquisitions. While there are industry differences, this spending behaviour is also exhibited by the coal panel (Figure 20) and by the gold panel (Figure 21).

While the decline of flow-through share financing is certainly a large factor in the dynamics of capital expenditures, there are a number of other factors involved in the decline as well. The termination of the Canadian Exploration Incentive Program (CEIP) in 1990, the effects of continuing low metal and flat nonmetal prices, combined with the recession and the lack of exploration success in recent years, have all had an impact on the dynamics of capital investment in the mining sector. Given our findings that modernization and replacement of

Figure 19

Mining Industry

Capital Machinery Expenditures versus Repair Machinery Expenditures, 1987-90

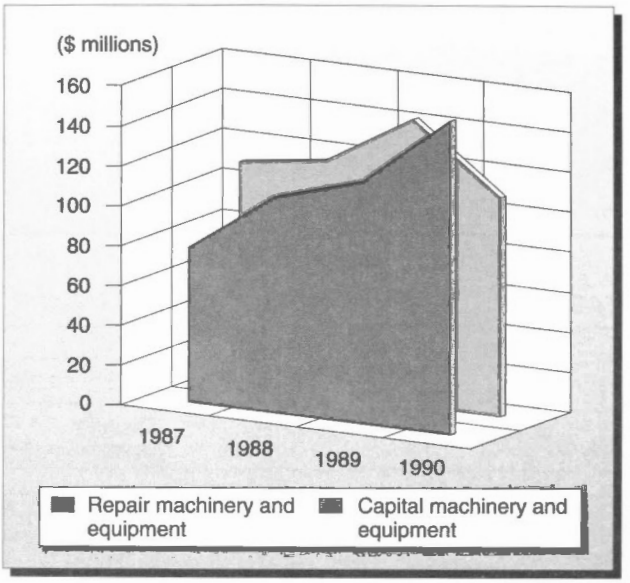


SOURCE: Statistics Canada, ICSD.

Figure 21

Panel of Gold Mining Respondents

Capital Machinery Expenditures versus Repair Machinery Expenditures, 1987-90

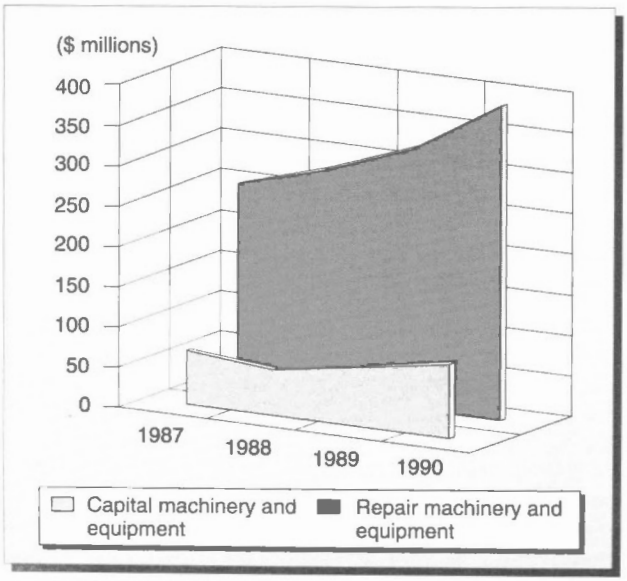


SOURCE: Statistics Canada, ICSD.

Figure 20

Panel of Coal Mining Respondents

Capital Machinery Expenditures versus Repair Machinery Expenditures, 1987-90



SOURCE: Statistics Canada, ICSD.

existing assets continue to be an important reason for capital investment, those who can weather the recession will be positioned to take advantage of opportunities when the recovery arrives.

REFERENCES

1 There are four stages: **Stage 1** – Primary Mineral Production (Mining); **Stage 2** – Primary Metal Production (Metallurgical Extraction Industry); **Stage 3** – Minerals and Metals-Based Semi-Fabricating Industry; **Stage 4** – Minerals and Metals-Based Fabrication Industry. For more information and analysis of these four stages, consult Energy, Mines and Resources' annual publication, *Canadian Minerals and Metals Industry: Trends and Short-Term Outlook*.

2 The actual expenditures for 1991 were in the final stages of completion at the time of writing.

3 Production activity is appraised in tonnes/day of capacity. The sources of these data are *Mining and Mineral Processing Operations in Canada: 1990*, by the Mineral Policy Sector, EMR, and the *Canadian Miners Handbook 1990-91* by Southam Business Communications Incorporated.

4 See Statistics Canada, *Exploration, Development and Capital Expenditures for Mining and Petroleum and Natural Gas Wells: Intentions 1992*. Catalogue 61-216.

5 Changes in the *Income Tax Act* in 1983 permitted the flow-through of the Mining Exploration Depletion Allowance (MEDA) to investors. This change made flow-through share financing a popular financing vehicle in the industry. See, for example, EMR, *Canadian Minerals and Metals Industry: Trends and Short-Term Outlook*.

6 See EMR, Mineral Policy Sector, *Canadian Minerals and Metals Industry: Trends and Short-Term Outlook*, November 1991, pp. 38-39.

7 The figures for on-property exploration are not shown in Figure 12. They are included separately as part of Figure 13.

8 General exploration expenditures represent spending on all activities applied to the search for and delineation of mineral deposits on properties where no production is taking place. Statistics Canada collects information on both general exploration and on-property exploration from producing mining establishments. The general exploration data from these establishments, however, contribute towards EMR's data series on general exploration activities.

9 Accumulated capital cost represents the total capital expenditures for an asset at and since the time of construction or purchase, including capital expenditures for the purposes of modernization, expansion, etc. Any subsidies received for the asset acquisition are not subtracted.

10 See, for example, EMR, *Canadian Minerals and Metals Industry: Trends and Short-Term Outlook*, November 1991, pp. 50-51.

BIBLIOGRAPHY

Diane Giancola (ed.), *Canadian Mines Handbook: 1992-1993*, Don Mills, Southam Business Communications Inc., 1992.

Energy Mines and Resources Canada, Mineral Policy Sector, *Canadian Minerals and Metals Industry: Trends and Short-Term Outlook*, various years.

Energy Mines and Resources Canada, Mineral Policy Sector, *Mining and Mineral Processing Operations in Canada: 1990*.

Statistics Canada, Investment and Capital Stock Division, *Exploration, Development and Capital Expenditures for Mining and Petroleum and Natural*

ANNEX 1. SUMMARY OF TOTAL CAPITAL EXPENDITURES

Year	Construction	Year/Year Change	Machinery and Equipment	Year/Year Change	Total Capital	Year/Year Change
	($ millions)	(%)	($ millions)	(%)	($ millions)	(%)
TOTAL METAL MINES						
1986	979.7		319.4		1 299.1	
1987	1 328.2	35.6	372.9	16.8	1 701.1	30.9
1988	1 609.0	21.1	566.5	51.9	2 175.5	27.9
1989	1 356.4	-15.7	578.6	2.1	1 935.0	-11.1
1990	1 358.7	0.2	420.9	-27.3	1 779.6	-8.0
1991	877.2	-35.4	412.5	-2.0	1 289.7	-27.5
1992	769.9	-12.2	386.2	-6.4	1 156.1	-10.4
TOTAL NONMETAL MINES						
1986	502.4		256.6		759.0	
1987	421.7	-16.1	251.6	-1.9	673.3	-11.3
1988	432.9	2.7	263.4	4.7	696.3	3.4
1989	417.1	-3.6	270.1	2.5	687.2	-1.3
1990	408.4	-2.1	263.5	-2.4	671.9	-2.2
1991	378.3	-7.4	214.3	-18.7	592.6	-11.8
1992	294.5	-22.2	254.3	18.7	548.8	-7.4
TOTAL MINING						
1986	1 482.1		576.0		2 058.1	
1987	1 749.9	18.1	624.5	8.4	2 374.4	15.4
1988	2 041.9	16.7	829.9	32.9	2 871.8	20.9
1989	1 773.5	-13.1	848.7	2.3	2 622.2	-8.7
1990	1 767.1	-0.4	684.4	-19.4	2 451.5	-6.5
1991	1 255.5	-29.0	626.8	-8.4	1 882.3	-23.2
1992	1 064.4	-15.2	640.5	2.2	1 704.9	-9.4

Note: Actual expenditures for 1986-90, preliminary actual for 1991, and revised intentions for 1992.

ANNEX 2. SUMMARY OF TOTAL CAPITAL EXPENDITURES BY SUB-INDUSTRY

Year	Construction	Year/Year Change	Machinery and Equipment	Year/Year Change	Total Capital	Year/Year Change
	($ millions)	(%)	($ millions)	(%)	($ millions)	(%)
METAL MINES						
Gold						
1986	395.9		120.1		516.0	
1987	748.9	89.2	171.1	42.5	920.0	78.3
1988	865.4	15.6	291.6	70.4	1 157.0	25.8
1989	663.6	-23.3	184.3	-36.8	847.9	-26.7
1990	464.8	-30.0	125.4	-32.0	590.2	-30.4
1991	198.0	-57.4	81.7	-34.8	279.7	-52.6
1992	190.5	-3.8	89.1	9.1	279.6	-0.0
Uranium						
1986	114.3		29.2		143.5	
1987	96.7	-15.4	16.1	-44.9	112.8	-21.4
1988	112.7	16.5	26.7	65.8	139.4	23.6
1989	94.6	-16.1	10.9	-59.2	105.5	-24.3
1990	133.3	40.9	5.0	-54.1	138.3	31.1
1991	53.7	-59.7	12.7	154.0	66.4	-52.0
1992	69.3	29.1	20.3	59.8	89.6	34.9
Iron						
1986	76.6		41.7		118.3	
1987	100.1	30.7	20.3	-51.3	120.4	1.8
1988	70.2	-29.9	13.3	-34.5	83.5	-30.6
1989	73.4	4.6	62.8	372.2	136.2	63.1
1990	125.7	71.3	61.6	-1.9	187.3	37.5
1991	118.3	-5.9	116.7	89.4	235.0	25.5
1992	89.9	-24.0	48.6	-58.4	138.5	-41.1
Copper-Gold-Silver						
1986	172.5		50.9		223.4	
1987	152.2	-11.8	67.0	31.6	219.2	-1.9
1988	286.6	88.3	84.8	26.6	371.4	69.4
1989	192.1	-33.0	102.3	20.6	294.4	-20.7
1990	207.6	8.1	61.1	-40.3	268.7	-8.7
1991	141.9	-31.6	68.2	11.6	210.1	-21.8
1992	161.4	13.7	86.8	27.3	248.2	18.1
Silver-Lead-Zinc						
1986	54.6		8.1		62.7	
1987	95.4	74.7	35.4	337.0	130.8	108.6
1988	114.5	20.0	40.4	14.1	154.9	18.4
1989	85.5	-25.3	79.6	97.0	165.1	6.6
1990	108.3	26.7	32.7	-58.9	141.0	-14.6
1991	163.7	51.2	19.7	-39.8	183.4	30.1
1992	82.1	-49.8	29.7	50.8	111.8	-39.0
Other Metals						
1986	165.8		69.4		235.2	
1987	134.9	-18.6	63.0	-9.2	197.9	-15.9
1988	159.6	18.3	109.7	74.1	269.3	36.1
1989	247.2	54.9	138.7	26.4	385.9	43.3
1990	319.0	29.0	135.1	-2.6	454.1	17.7
1991	201.6	-36.8	113.5	-16.0	315.1	-30.6
1992	176.7	-12.4	111.7	-1.6	288.4	-8.5
NONMETAL MINES						
Coal						
1986	339.9		89.2		429.1	
1987	239.5	-29.5	88.7	-0.6	328.2	-23.5
1988	215.1	-10.2	115.6	30.3	330.7	0.8
1989	204.0	-5.2	97.9	-15.3	301.9	-8.7
1990	204.7	0.3	125.1	27.8	329.8	9.2
1991	262.5	28.2	98.1	-21.6	360.6	9.3
1992	170.0	-35.2	125.9	28.3	295.9	-17.9
Asbestos						
1986	41.4		2.2		43.6	
1987	46.5	12.3	8.8	300.0	55.3	26.8
1988	56.1	20.6	3.0	-65.9	59.1	6.9
1989	75.4	34.4	2.0	-33.3	77.4	31.0
1990	63.1	-16.3	1.1	-45.0	64.2	-17.1
1991	29.1	-53.9	3.1	181.8	32.2	-49.8
1992	57.4	97.3	1.0	-67.7	58.4	81.4
Other Nonmetals						
1986	121.1		165.2		286.3	
1987	135.7	12.1	154.1	-6.7	289.8	1.2
1988	161.7	19.2	144.8	-6.0	306.5	5.8
1989	137.7	-14.8	170.2	17.5	307.9	0.5
1990	140.6	2.1	137.3	-19.3	277.9	-9.7
1991	86.7	-38.3	113.1	-17.6	199.8	-28.1
1992	67.1	-22.6	127.4	12.6	194.5	-2.7

Note: Actual expenditures for 1986-90, preliminary actual for 1991, and revised intentions for 1992.

Statistical Tables

TABLE 1. CANADA, PRODUCTION OF LEADING MINERALS

		1991			1992			Percentage Changes		
		September	October	Total 10 Months	September	October	Total 10 Months	October 1992 / October 1991	October 1992 / September 1992	10 Months 1992 / 1991
		(000 tonnes except where noted)								
METALS										
Copper		60.2r	64.1r	644.9	62.5r	64.2r	626.8r	–	2.6	–2.8
Gold	kg	14 981.4r	14 399.0r	147 956.7r	13 864.8r	12 971.5r	133 162.6r	–9.9	–6.4	–10.0
Iron ore		3 135.6	3 880.3	27 767.5	2 971.8	3 437.4	26 398.7	–11.4	15.7	–4.9
Lead		32.0r	26.2r	201.0r	34.0r	38.4r	273.7r	46.5	13.1	36.2
Molybdenum	t	934.9r	750.0r	10 198.4r	841.8r	726.6	7 200.6	–3.1	–13.7	–29.4
Nickel		15.6r	17.4r	156.0r	17.6r	17.4r	155.1r	0.2	–0.8	–0.6
Silver	t	117.5r	116.1	1 080.2	90.8r	88.4	947.8	–23.9	–2.7	–12.3
Uranium[1]	t	946.8r	1 038.1r	6 748.3r	1 110.4	1 101.8	8 199.8	6.1	–0.8	21.5
Zinc		126.1r	101.5r	908.9r	122.5r	118.9r	1 023.7r	17.2	–3.0	12.6
NONMETALS										
Asbestos		61.5r	70.5r	559.6r	46.7	56.8	500.2r	–19.5	21.6	–10.6
Clay products	$000	13 096.6r	13 596.6r	103 924.1r	12 884.2	14 967.9	105 761.7	10.1	16.2	1.8
Gypsum		708.5r	642.6r	5 550.9r	684.3	718.3	6 551.3	11.8	5.0	18.0
Potash K_2O		582.6	496.3	5 892.1	586.5	553.2	6 079.0r	11.5	–5.7	3.2
Cement		1 062.2	976.9	8 205.8	1 000.7	910.0r	7 437.3r	–6.8	–9.1	–9.4
Lime		195.0	224.9	1 966.9	208.5	192.7	1 973.9	–14.3	–7.6	0.4
Salt		1 086.5r	1 140.0r	9 408.8	1 053.6	1 141.6	8 847.7	0.1	8.3	–6.0
FUELS										
Coal		5 642.4	6 298.6	58 764.9	4 887.6r	5 000.7	55 246.9	–20.6	2.3	–6.0
Natural gas	million m^3	9 609.0r	11 415.0r	105 533.0	11 291.0	11 594.0	115 271.0	1.6	2.7	9.2
Crude oil and equivalent	000 m^3	7 866.0r	7 957.0r	79 947.0	8 265.0r	8 890.0	84 006.0	11.7	7.6	5.1

Sources: Energy, Mines and Resources Canada; Statistics Canada.
– Nil; r Revised.
1 Tonnes uranium (1 tonne U = 1.2999 short tons U_3O_8).
Note: Percentage changes are calculated on the basis of actual production figures as opposed to the rounded figures as shown.

TABLE 1A. CANADA, PRODUCTION OF LEADING MINERALS

		1991			1992			Percentage Changes		
		November	December	Total 12 Months	November	December	Total 12 Months	December 1992 / December 1991	December 1992 / November 1992	12 Months 1992 / 1991
		(000 tonnes except where noted)								
METALS										
Copper		67.7r	67.7r	780.4r	62.0	57.4	746.3	–15.2	–7.4	–4.4
Gold	kg	14 103.4r	13 222.1r	175 282.1r	11 869.1	12 391.1	157 422.8	–6.3	4.4	–10.2
Iron ore		4 028.6	4 120.7r	35 916.8r	2 883.6	2 955.4	32 237.7	–28.3	2.5	–10.2
Lead		23.3r	23.8r	248.1r	24.9r	21.4	320.0	–10.0	–14.2	29.0
Molybdenum	t	619.0r	619.5r	11 436.8r	868.1	929.9	8 998.7	50.1	7.1	–21.3
Nickel		15.9r	16.2r	188.1r	17.2	8.6	180.9	–46.9	–50.0	–3.8
Silver	t	83.9	97.3r	1 261.4r	89.5r	91.1	1 128.3	–6.4	1.8	–10.5
Uranium[1]	t	992.5r	420.9r	8 161.7r	602.2	251.8	9 053.8	–40.2	–58.2	10.9
Zinc		86.2r	87.9r	1 083.0r	82.1r	79.7	1 185.5	–9.3	–2.9	9.5
NONMETALS										
Asbestos		68.6r	57.8r	686.0r	46.6	47.6	594.4	–17.7	2.2	–13.4
Clay products	$000	8 678.3r	5 299.3r	117 901.8r	8 456.4	7 430.8	121 648.9	40.2	–12.1	3.2
Gypsum		563.8r	612.5r	6 727.2r	592.3	503.9	7 647.4	–17.7	–14.9	13.7
Potash K_2O		598.7r	596.2r	7 087.0r	407.1	498.3	6 984.4	–16.4	22.4	–1.4
Cement		721.2r	445.3	9 372.2r	699.4	461.6	8 598.2	3.7	–34.0	–8.3
Lime		204.9	203.4r	2 375.3r	202.5	206.6	2 382.9	1.5	2.0	0.3
Salt		1 122.2r	1 339.8r	11 870.9r	1 030.0	1 067.3	10 944.9	–20.3	3.6	–7.8
FUELS										
Coal		6 228.9	6 140.5r	71 134.3r	5 052.0	..	..	..	..	..
Natural gas	million m^3	11 937.0r	13 165.0r	130 635.0	..	..	..	..	..	..
Crude oil and equivalent	000 m^3	8 344.0r	8 457.0r	96 748.0	..	..	..	..	..	..

Sources: Energy, Mines and Resources Canada; Statistics Canada.
.. Not available; r Revised.
[1] Tonnes uranium (1 tonne U = 1.2999 short tons U_3O_8).
Note: Percentage changes are calculated on the basis of actual production figures as opposed to the rounded figures as shown.

TABLE 2. METAL PRICES, 1992

	November	December	Annual Average
COPPER			
Electrolytic, U.S. producer f.o.b. refinery, cents (US)	99.990	102.144	106.023
Electrolytic, COMEX, 1st pos. plus 5¢, cents (US)	96.205	99.127	102.721
Electrolytic, LME Grade A settlement, cents (US)	97.898	100.100	103.472
LEAD			
U.S. producer, cents (US)	32.000	32.000	34.708
Montreal, cents (C)	44.000	44.000	41.469
LME cash, cents (US)	20.865	20.602	24.534
SILVER			
Handy & Harmon, cents per troy oz (US)	376.316	370.976	393.621
Handy & Harmon, cents per troy oz (C)	424.031	472.141	451.011
ZINC			
LME SHG cash, cents (US)	47.487	47.986	56.235
North American SHG, cents (US)	50.006	50.121	58.399
TIN			
New York, dealers, cents (US)	264.812	266.143	282.236
Metals Week, composite, cents (US)	380.422	380.873	402.402
GOLD			
London, p.m., US$ per troy oz	335.017	334.803	343.731
NICKEL			
New York, dealers, cathode, US$	2.499	2.589	3.177
LME cash, US$	2.524	2.596	3.176
ANTIMONY			
New York, dealers, cents (US)	78.000	78.000	79.087
PLATINUM			
London PM fix, US$ per troy oz	356.110	362.542	359.799
CADMIUM			
New York, dealers, US$	0.700	0.600	0.907
ALUMINUM			
LME cash, cents (C)	59.240	69.684	65.188
LME cash, cents (US)	52.574	54.753	56.893
COBALT			
Shot/cathode/250 kg, US$	23.600	18.000	24.300
U.S. spot cathode, US$	15.750	15.438	22.183
TUNGSTEN			
U.S. spot ore, US$/MTU	46.297	46.297	54.372
MOLYBDENUM			
Metals Week dealer oxide, US$	1.968	1.828	2.178
URANIUM			
Nuexco, US$, U_3O_8	8.750	8.163	8.024

Sources: Metals Week; The Northern Miner.
Average U.S. Exchange Rate for November = 1.2680, December = 1.2727.
Notes: Prices are per pound unless otherwise stated.

TABLE 3. CANADA, REAL GROSS DOMESTIC PRODUCT AT FACTOR COST BY INDUSTRY, IN 1986 PRICES, QUARTERLY (SEASONALLY ADJUSTED AT ANNUAL RATES)

Industry Sector	1991 3rd Quarter	1991 4th Quarter	1992 1st Quarter	1992 2nd Quarter	1992 3rd Quarter	% Change 3rd Quarter 1992 / 2nd Quarter 1992	% Change 3rd Quarter 1992 / 3rd Quarter 1991
			($ million)				
TOTAL ECONOMY	499 246.8	499 281.0	500 001.5	501 451.0	504 158.2	0.5	1.0
Business Sector							
Agriculture	11 279.2	11 287.9	11 085.1	10 889.6	10 476.7	-3.8	-7.1
Fishing and trapping	982.0	935.9	917.2	936.9	891.1	-4.9	-9.3
Forestry	2 428.5	2 498.0	2 457.4	2 446.5	2 521.1	3.0	3.8
Mines, quarries and oil wells	**19 943.9**	**20 005.2**	**20 049.5**	**20 360.4**	**20 832.4**	**2.3**	**4.5**
Mining industries	6 336.9	6 290.9	6 212.2	5 991.4	6 021.2	0.5	-5.0
Gold mines	1 619.9	1 548.9	1 528.3	1 470.3	1 503.1	2.2	-7.2
Other metal mines	2 399.0	2 335.3	2 315.3	2 403.0	2 505.1	4.2	4.4
Iron mines	486.2	502.2	496.6	494.2	397.7	-19.5	-18.2
Asbestos mines	101.2	104.4	91.2	84.0	78.0	-7.1	-22.9
Nonmetal mines - Other	527.5	546.0	554.4	514.4	612.5	19.1	16.1
Salt mines	153.0	157.0	149.8	148.2	146.6	-1.1	-4.2
Coal mines	1 050.1	1 097.2	1 076.5	877.3	778.3	-11.3	-25.9
Crude petroleum and natural gas	11 744.1	12 013.0	12 237.6	12 662.8	13 153.6	3.9	12.0
Quarry and sand pit industries	637.4	602.3	567.7	599.3	614.9	2.6	-3.5
Services related to mineral extraction	1 225.5	1 099.0	1 032.1	1 106.9	1 042.7	-5.8	-14.9
Manufacturing	85 876.1	84 717.1	84 405.1	84 584.2	84 966.6	0.5	-1.1
Construction industry	31 363.7	31 532.3	30 697.5	29 735.9	29 560.5	-0.6	-5.7
Transportation and storage	21 370.8	21 401.3	21 657.2	21 817.8	22 112.3	1.3	3.5
Communications	18 946.0	19 251.1	19 308.0	19 444.0	19 510.5	0.3	3.0
Other utilities	15 974.2	16 012.8	16 059.8	16 067.2	16 063.3	-0.0	0.6
Wholesale trade	28 243.4	28 377.3	28 562.5	29 227.0	29 826.1	2.0	5.6
Retail trade	29 811.3	29 766.9	29 922.7	30 021.6	30 260.6	0.8	1.5
Finance, insurance and real estate	80 822.8	81 793.5	82 614.1	83 261.1	84 242.6	1.2	4.2
Community, business and personal services	60 869.4	59 828.1	60 035.5	60 521.5	60 587.6	0.1	-0.5
Non-Business Sector							
Government service industries	33 402.0	33 911.6	34 131.1	34 030.3	34 024.7	-0.0	1.9
Community and personal services	53 453.3	53 556.6	53 733.6	53 735.9	53 880.3	0.3	0.8
Other non-business industries and services	4 480.2	4 405.4	4 365.2	4 371.1	4 401.8	0.7	-1.7

Source: Statistics Canada.
Note: Numbers may not add to totals due to rounding.

TABLE 4. CANADA, REAL GROSS DOMESTIC PRODUCT AT FACTOR COST BY INDUSTRIES INVOLVED IN MINERAL MANUFACTURING, IN 1986 PRICES, QUARTERLY (SEASONALLY ADJUSTED AT ANNUAL RATES)

Industry	1991 3rd Quarter	1991 4th Quarter	1992 1st Quarter	1992 2nd Quarter	1992 3rd Quarter	% Change 3rd Quarter 1992 / 2nd Quarter 1992	% Change 3rd Quarter 1992 / 3rd Quarter 1991
			($ million)				
PRIMARY METAL INDUSTRIES	**6 771.3**	**6 752.3**	**6 489.7**	**6 484.5**	**6 654.3**	**2.6**	**-1.7**
Primary steel industries	2 742.2	2 759.8	2 611.1	2 622.7	2 644.7	0.8	-3.6
Steel, pipe and tube industries	527.1	538.1	406.6	343.4	354.6	3.3	-32.7
Iron foundries	284.8	282.4	287.2	300.4	299.2	-0.4	5.1
Nonferrous smelting and refining industries	2 368.3	2 339.8	2 337.4	2 360.2	2 482.0	5.2	4.8
FABRICATED METAL PRODUCTS INDUSTRIES	**5 655.4**	**5 403.1**	**5 307.6**	**5 329.2**	**5 258.6**	**-1.3**	**-7.0**
Power boiler and structural metal industry	1 077.0	1 030.5	1 019.2	1 008.5	914.3	-9.3	-15.1
Ornamental and architectural metal products industry	667.9	640.1	609.3	608.9	596.8	-2.0	-10.6
Stamped, pressed and coated metals	1 246.3	1 167.9	1 160.5	1 169.3	1 197.4	2.4	-3.9
Wire and wire products industries	479.4	472.7	460.5	471.7	486.9	3.2	1.6
Hardware, tool and cutlery industries	762.0	743.5	744.6	753.4	761.0	1.0	-0.1
Heating equipment industry	174.1	173.3	170.0	184.4	204.5	10.9	17.5
Machine shops industry	640.7	580.7	572.3	558.3	527.4	-5.5	-17.7
Other metal fabricating industries	608.0	594.3	571.1	574.7	570.3	-0.8	-6.2
NONMETALLIC MINERAL PRODUCTS INDUSTRIES	**2 642.3**	**2 552.9**	**2 394.5**	**2 477.2**	**2 441.5**	**-1.4**	**-7.6**
Cement industry	365.0	349.1	316.1	332.2	335.0	0.8	-8.2
Concrete products industries	349.8	327.2	303.8	329.8	333.0	1.0	-4.8
Ready-mix concrete industry	413.3	394.7	361.9	379.5	380.0	0.1	-8.1
Glass and glass products industries	561.5	540.6	528.0	536.8	496.3	-7.5	-11.6
Miscellaneous nonmetallic mineral products	816.6	813.4	767.7	779.3	775.7	-0.5	-5.0

Source: Statistics Canada.
Note: Items may not add to totals given since all components are not shown.

TABLE 5. MINERAL PRODUCTION OF CANADA, 1990, 1991 AND 1992, AND AVERAGE, 1988-92

	Unit of Measure	1990		1991		1992P		Average 1988-92	
	(000)	(Quantity)	($000)	(Quantity)	($000)	(Quantity)	($000)	(Quantity)	($000)
METALS									
Antimony	kg	565	1 188	429	897	276	574	1 452	3 542
Bismuth	kg	74	664	60	446	89	589	112	1 365
Cadmium	kg	1 334	11 588	1 549	7 724	1 328	3 240	1 517	16 465
Calcium	kg	x	x	x	x	x	x	203	2 052
Cesium, pollucite	kg	x	x	x	x	x	x	174	506
Cobalt	kg	2 184	49 563	2 171	77 549	2 219	136 886	2 263	70 974
Columbium (Niobium) (Cb_2O_5)	kg	x	x	x	x	x	x	3 395	21 682
Copper	kg	771 433	2 428 935	780 362	2 112 152	744 687	2 062 873	751 879	2 277 255
Germanium	kg	4	1 083	–	–	–	–	2	528
Gold	g	167 373	2 407 654	176 126	2 349 872	157 554	2 086 803	159 072	2 298 435
Ilmenite	t	554	x	x	x	x	x	475	21 751
Indium	g	x	x	x	x	x	x	15 583	3 767
Iron ore	t	35 670	1 258 792	35 421	1 228 188	32 772	1 129 371	36 648	1 261 759
Iron remelt	t	728	x	x	x	x	x	751	188 879
Lead	kg	233 372	279 346	248 102	210 886	318 515	230 923	284 005	271 373
Lithium	kg	x	x	x	x	x	x	958	4 245
Magnesium	kg	x	x	x	x	x	x	5 566	20 525
Molybdenum	kg	12 188	84 721	11 437	65 928	9 602	62 866	12 061	89 270
Nickel	kg	195 004	2 027 917	188 098	1 807 619	189 051	1 679 853	193 290	2 269 617
Platinum group	g	11 123	189 423	11 123	150 155	10 505	117 099	11 032	157 864
Rare earths	t	–	–	–	–	–	–	. . .	x
Rhenium	kg	x	x	x	x	x	x	1	1 229
Rubidium	kg	x	x	x	x	x	x	3	33
Selenium	kg	369	6 867	227	3 937	286	4 715	283	5 689
Silver	kg	1 381	249 746	1 261	187 676	1 147	173 219	1 309	254 330
Strontium	kg	x	x	x	x	x	x	x	x
Tantalum (Ta_2O_5)	kg	100	8 762	114	10 254	65	5 222	79	7 295
Tellurium	kg	12	994	16	1 128	26	1 982	16	1 140
Tin	kg	3 844	28 449	4 392	25 241	–	–	3 100	24 754
Tungsten (WO_3)	kg	–	–	–	–	–	–	–	–
Uranium (U)	kg	9 720	887 975	8 162	595 467	9 057	575 587	10 000	798 076
Vanadium	kg	x	x	x	x	–	–	8	36
Yttrium (Y_2O_3)	kg	x	x	–	–	–	–	45	1 780
Zinc	kg	1 179 372	2 272 649	1 083 008	1 385 167	1 193 607	1 727 150	1 219 768	2 077 752
Total metals			12 499 965		10 473 055		10 209 192		12 154 512
NONMETALS									
Arsenious trioxide	t	x	240	–	–	–	–	3	779
Asbestos	t	686	272 102	686	271 030	601	235 760	679	263 827
Barite	t	44	3 130	47	3 013	32	2 854	43	3 216
Fluorspar	t	x	x	–	–	–	–	23	2 996
Gemstones	kg	452	918	542	663	515	582	580	1 509
Graphite	t	x	x	x	x	x	x	10	8 074
Gypsum	t	7 978	80 080	6 727	71 654	6 892	79 206	7 718	80 461
Magnesite	t	x	x	x	x	x	x	178	23 864
Marl	t	x	x	x	x	x	x	1	17
Mica	t	x	x	x	x	x	x	17	6 602
Nepheline syenite	t	533	23 651	486	25 105	566	28 711	535	24 464
Peat	t	775	89 735	833	100 133	856	108 199	804	96 113
Potash (K_2O)	t	7 345	964 920	7 087	931 932	7 324	963 260	7 385	1 009 077
Potassium sulphate	t	x	x	x	x	x	x	2	722
Salt	t	11 191	240 890	11 871	259 166	11 100	253 802	11 202	255 240
Serpentine	t	x	x	x	x	x	x	4	588
Soapstone, talc and pyrophyllite	t	131	13 895	115	13 278	122	13 481	132	14 357
Sodium sulphate	t	347	27 088	335	25 457	280	21 038	324	24 989
Sulphur in smelter gas	t	790	81 229	749	89 187	774	79 155	796	84 332
Sulphur, elemental	t	5 822	368 864	6 180	335 381	6 350	131 385	6 017	339 835
Titanium dioxide	t	x	x	x	x	x	x	689	248 281
Tremolite	t	x	x	x	x	x	x	. . .	49
Total nonmetals			2 492 168		2 381 705		2 199 379		2 489 391
FUELS									
Coal	t	68 332	1 823 700	71 133	1 916 780	64 550	1 663 300	69 037	1 823 038
Natural gas	000m^3	98 771	5 692 025	105 244	5 394 073	118 925	5 607 705	101 994	5 459 028
Natural gas by-products	m^3	23 863	2 370 767	24 919	2 178 094	26 551	2 296 825	24 189	2 011 921
Petroleum, crude	m^3	90 279	13 103 383	89 788	10 456 364	93 997	11 251 095	91 702	10 968 334
Total fuels			22 989 875		19 945 311		20 818 925		20 262 321
STRUCTURAL MATERIALS									
Clay products	$	. .	136 029	. .	119 838	. .	117 326	. .	154 011
Cement	t	11 745	991 442	9 372	810 769	8 484	739 211	10 908	894 543
Lime	t	2 341	188 283	2 375	193 541	2 383	182 834	1 924	191 580
Sand and gravel	t	244 316	817 317	216 264	741 326	201 082	637 035	189 912	787 131
Stone	t	111 355r	663 354r	87 826	539 654	81 639	507 645	104 056	603 165
Total structural materials			2 796 426r		2 405 128		2 184 052		2 630 431
Total all minerals			40 778 434r		35 205 199		35 411 548		37 536 655

Sources: Energy, Mines and Resources Canada; Statistics Canada.
– Nil; . . Not available; . . . Amount too small to be expressed; P Preliminary; r Revised; x Confidential.
Notes: Numbers may not add to totals due to rounding. Confidential values are included in totals.

TABLE 6. CANADA, VALUE OF MINERAL PRODUCTION, PER CAPITA VALUE OF MINERAL PRODUCTION, AND POPULATION, 1963-92

	Metallics	Industrial Minerals	Fuels	Other Minerals[1]	Total	Per Capita Value of Mineral Production	Population of Canada
			($ million)			($)	(000)
1963	1 510	632	885		3 027	159.91	18 931
1964	1 702	691	973		3 365	174.44	19 291
1965	1 908	761	1 046		3 715	189.11	19 644
1966	1 985	844	1 152		3 981	198.88	20 015
1967	2 285	861	1 235		4 381	214.98	20 378
1968	2 493	886	1 343		4 722	228.12	20 701
1969	2 378	893	1 465		4 736	225.51	21 001
1970	3 073	931	1 718		5 722	268.68	21 297
1971	2 940	1 008	2 014		5 963	276.46	21 568
1972	2 956	1 085	2 368		6 408	293.92	21 802
1973	3 850	1 292	3 227		8 370	379.69	22 043
1974	4 821	1 731	5 202		11 753	525.55	22 364
1975	4 795	1 898	6 653		13 347	588.05	22 697
1976	5 315	2 269	8 109		15 693	682.51	22 993
1977	5 988	2 612	9 873		18 473	794.24	23 258
1978	5 698	2 986	11 578		20 261	863.05	23 476
1979	7 951	3 514	14 617		26 081	1 101.83	23 671
1980	9 697	4 201	17 944		31 842	1 330.29	23 936
1981	8 753	4 485	19 046	136	32 420	1 331.86	24 342
1982	6 874	3 703	23 038	216	33 831	1 373.37	24 634
1983	7 399	3 741	27 154	245	38 539	1 548.68	24 885
1984	8 670	4 318	30 399	401	43 789	1 742.92	25 124
1985	8 709	4 859	31 120	41	44 730	1 763.79	25 360
1986	8 798	4 863	18 763	22	32 446	1 279.77	25 353
1987	10 962	5 125	20 274	–	36 361	1 419.39	25 617
1988	13 608	5 574	17 773	–	36 955	1 426.33	25 909
1989	13 982	5 566	19 785	–	39 333	1 498.97	26 240
1990	12 500	5 289r	22 990	–	40 778r	1 532.87r	26 603
1991	10 473	4 787	19 945	–	35 205	1 303.88	27 000
1992p	10 209	4 383	20 819	–	35 412	1 291.97	27 409

Sources: Energy, Mines and Resources Canada; Statistics Canada.
– Nil; p Preliminary; r Revised.
1 1981-86 – Other minerals may include arsenious trioxide, bentonite, calcium, cesium, cobalt, diatomite, ilmenite, indium, iron remelt, lithium, marl, magnesium, niobium, perlite, rhenium, serpentine, sodium antimonate, strontium, tin, tungsten or yttrium, for which the value of production may be confidential in that year. Beginning 1987, this category was discontinued.
Notes: Beginning 1986, bentonite, diatomite and sodium antimonate are reported in industrial minerals. Numbers may not add to totals due to rounding.

TABLE 7. CANADA, VALUE OF MINERAL PRODUCTION BY PROVINCE, TERRITORY AND MINERAL CLASS, 1992p

	Metals		Industrial Minerals		Fuels		Total	
	($000)	(% of total)	($000)	(% of total)	($000)	(% of total)	($000)	(% of total)
Alberta	464	. . .	386 756	8.8	16 691 427	80.2	17 078 646	48.2
Ontario	3 562 432	34.9	1 143 493	26.1	74 528	0.4	4 780 453	13.5
British Columbia	1 447 125	14.2	399 826	9.1	1 600 734	7.7	3 447 686	9.7
Saskatchewan	407 985	4.0	849 239	19.4	1 795 431	8.6	3 052 656	8.6
Quebec	1 629 749	16.0	1 000 692	22.8	–	–	2 630 441	7.4
Manitoba	956 456	9.4	92 496	2.1	87 078	0.4	1 136 029	3.2
New Brunswick	568 207	5.6	285 616	6.5	32 000	0.2	885 822	2.5
Newfoundland	697 565	6.8	37 737	0.9	–	–	735 302	2.1
Northwest Territories	476 160	4.7	6 758	0.2	170 397	0.8	653 315	1.8
Nova Scotia	402	. . .	172 181	3.9	367 330	1.8	539 913	1.5
Yukon	462 648	4.5	5 223	0.1	–	–	467 871	1.3
Prince Edward Island	–	–	3 414	0.1	–	–	3 414	. . .
Total	10 209 192	100.0	4 383 431	100.0	20 818 925	100.0	35 411 548	100.0

Sources: Energy, Mines and Resources Canada; Statistics Canada.
– Nil; . . . Amount too small to be expressed; p Preliminary.
Note: Numbers may not add to totals due to rounding.

TABLE 8. CANADA, VALUE OF MINERAL PRODUCTION BY PROVINCE, TERRITORY AND MINERAL CLASS, 1991

	Metals		Industrial Minerals		Fuels		Total	
	($000)	(% of total)	($000)	(% of total)	($000)	(% of total)	($000)	(% of total)
Alberta	3 010	...	601 292	12.6	15 768 629	79.1	16 372 931	46.5
Ontario	3 783 916	36.1	1 236 575	25.8	80 973	0.4	5 101 464	14.5
British Columbia	1 522 200	14.5	449 063	9.4	1 879 908	9.4	3 851 171	10.9
Quebec	1 887 985	18.0	1 042 025	21.8	–	–	2 930 011	8.3
Saskatchewan	373 026	3.6	866 494	18.1	1 623 466	8.1	2 862 986	8.1
Manitoba	947 610	9.0	88 694	1.9	90 884	0.5	1 127 188	3.2
Newfoundland	734 397	7.0	37 872	0.8	–	–	772 269	2.2
Northwest Territories	477 572	4.6	11 527	0.2	222 026	1.1	711 126	2.0
New Brunswick	375 427	3.6	261 863	5.5	34 185	0.2	671 475	1.9
Nova Scotia	32 425	0.3	182 950	3.8	245 240	1.2	460 615	1.3
Yukon	335 486	3.2	5 217	0.1	–	–	340 703	1.0
Prince Edward Island	–	–	3 261	0.1	–	–	3 261	...
Total	10 473 055	100.0	4 786 833	100.0	19 945 311	100.0	35 205 199	100.0

Sources: Energy, Mines and Resources Canada; Statistics Canada.
– Nil; ... Amount too small to be expressed.
Note: Numbers may not add to totals due to rounding.

TABLE 9. CANADA, VALUE OF MINERAL PRODUCTION BY PROVINCE AND TERRITORY, 1986-92

	1986	1987	1988	1989	1990	1991	1992p
				($ million)			
Alberta	16 331	17 080	15 062	16 456	19 111r	16 373	17 079
Ontario	4 825	5 652	6 895	7 308	6 446	5 101	4 780
British Columbia	3 160	3 615	3 943	4 123	3 954	3 851	3 448
Saskatchewan	2 525	3 151	3 043	3 017	3 183	2 863	3 053
Quebec	2 191	2 780	2 712	2 878	3 037	2 930	2 630
Manitoba	764	1 000	1 627	1 668	1 311r	1 127	1 136
New Brunswick	502	624	911	859	878	671	886
Newfoundland	817	743	865	897	866	772	735
Northwest Territories	788	870	957	1 149	988	711	653
Nova Scotia	367	407	446	442	459	461	540
Yukon	176	437	492	534	542	341	468
Prince Edward Island	2	3	2	2	3	3	3
Total	32 446	36 361	36 955	39 333	40 778r	35 205	35 412

Sources: Energy, Mines and Resources Canada; Statistics Canada.
p Preliminary; r Revised.
Note: Numbers may not add to totals due to rounding.

TABLE 10. CANADA, PERCENTAGE CONTRIBUTION OF PROVINCES AND TERRITORIES TO TOTAL VALUE OF MINERAL PRODUCTION, 1986-92

	1986	1987	1988	1989	1990	1991	1992p
Alberta	50.3	47.0	40.8	41.8	46.9r	46.5	48.2
Ontario	14.9	15.5	18.7	18.6	15.8	14.5	13.5
British Columbia	9.7	9.9	10.7	10.5	9.7	10.9	9.7
Saskatchewan	7.8	8.7	8.2	7.7	7.8	8.1	8.6
Quebec	6.8	7.6	7.3	7.3	7.4	8.3	7.4
Manitoba	2.4	2.8	4.4	4.2	3.2r	3.2	3.2
New Brunswick	1.5	1.7	2.5	2.2	2.2	1.9	2.5
Newfoundland	2.5	2.0	2.3	2.3	2.1	2.2	2.1
Northwest Territories	2.4	2.4	2.6	2.9	2.4	2.0	1.8
Nova Scotia	1.1	1.1	1.2	1.1	1.1	1.3	1.5
Yukon	0.5	1.2	1.3	1.4	1.3	1.0	1.3
Prince Edward Island	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Sources: Energy, Mines and Resources Canada; Statistics Canada.
. . . Amount too small to be expressed; p Preliminary; r Revised.
Note: Numbers may not add to totals due to rounding.

TABLE 11. CANADA, PRODUCTION OF LEADING MINERALS, 1991 AND 1992

		Volume		Percent Change	Value		Percent Change
		1991	1992p	1991/1992	1991	1992p	1991/1992
		(000 tonnes except where noted)			($ millions)		
METALS							
Gold	kg	176 125.9	157 554.0	–10.5	2 349.9	2 086.8	–11.2
Copper		780.4	744.7	–4.6	2 112.2	2 062.9	–2.3
Zinc		1 083.0	1 193.6	10.2	1 385.2	1 727.1	24.7
Nickel		188.1	189.1	0.5	1 807.6	1 679.9	–7.1
Iron ore		35 421.2	32 771.9	–7.5	1 228.2	1 129.4	–8.0
Uranium	tU	8 161.7	9 057.5	11.0	595.5	575.6	–3.3
Lead		248.1	318.5	28.4	210.9	230.9	9.5
Silver	t	1 261.4	1 147.4	–9.0	187.7	173.2	–7.7
Cobalt		2.2	2.2	2.2	77.5	136.9	76.5
Platinum group	kg	11 122.6	10 504.7	–5.6	150.2	117.1	–22.0
NONMETALS							
Potash (K_2O)		7 087.0	7 324.2	3.3	931.9	963.3	3.4
Salt		11 870.9	11 100.4	–6.5	259.2	253.8	–2.1
Asbestos		686.0	601.3	–12.4	271.0	235.8	–13.0
Sulphur, elemental		6 180.0	6 349.7	2.7	335.4	131.4	–60.8
Peat		833.1	855.6	2.7	100.1	108.2	8.1
Gypsum		6 727.2	6 891.9	2.4	71.7	79.2	10.5
STRUCTURALS							
Cement		9 372.2	8 483.7	–9.5	810.8	739.2	–8.8
Sand and gravel		216 263.9	201 081.8	–7.0	741.3	637.0	–14.1
Stone		87 825.7	81 639.1	–7.0	539.7	507.6	–5.9
Lime		2 375.3	2 383.3	0.3	193.5	182.8	–5.5
Clay products		..	..	..	119.8	117.3	–2.1
FUELS							
Petroleum	000 m^3	89 788.4	93 997.1	4.7	10 456.4	11 251.1	7.6
Natural gas	million m^3	105 243.7	118 925.4	13.0	5 394.1	5 607.7	4.0
Natural gas by-products	000 m^3	24 918.8	26 551.4	6.6	2 178.1	2 296.8	5.5
Coal		71 133.0	64 550.0	–9.3	1 916.8	1 663.3	–13.2

Sources: Energy, Mines and Resources Canada; Statistics Canada.
.. Not available; p Preliminary.
Note: Figures have been rounded.

TABLE 12. VALUE OF LEADING MINERALS IN THE PROVINCES, TERRITORIES AND CANADA, 1991 AND 1992

	Value of Production			
	1991	1992p	Change 1992/1991	1992p Proportion of Provincial Total
	($ million)		(percent)	
NEWFOUNDLAND				
Iron ore	714.9	680.2	–4.9	92.5
Gold	x	x	x	x
Cement	x	x	x	x
Sand and gravel	11.4	11.6	1.8	1.6
Stone	7.7	4.9	–36.4	0.7
Asbestos	3.3	4.6	39.4	0.6
Total	772.3	735.3	–4.8	100.0
PRINCE EDWARD ISLAND				
Sand and gravel	3.3	3.4	3.0	100.0
Total	3.3	3.4	3.0	100.0
NOVA SCOTIA				
Coal	245.2	265.0	8.1	49.1
Petroleum, crude	–	102.3	. .	18.9
Gypsum	49.9	55.2	10.6	10.2
Salt	x	x	x	x
Cement	x	x	x	x
Sand and gravel	21.7	20.4	–6.0	3.8
Stone	24.8	19.8	–20.2	3.7
Total	460.6	539.9	17.2	100.0
NEW BRUNSWICK				
Zinc	268.3	426.8	59.1	48.2
Potash (K_2O)	x	x	x	x
Lead	44.2	56.1	26.9	6.3
Copper	28.4	43.2	52.1	4.9
Silver	23.6	36.1	53.0	4.1
Total	671.5	885.8	31.9	100.0
QUEBEC				
Gold	692.8	590.0	–14.8	22.4
Iron ore	x	x	x	x
Copper	308.4	255.2	–17.3	9.7
Titanium dioxide	x	x	x	x
Asbestos	226.3	224.8	–0.7	8.5
Stone	208.8	205.8	–1.4	7.8
Total	2 930.0	2 630.4	–10.2	100.0
ONTARIO				
Nickel	1 219.3	1 112.9	–8.7	23.3
Gold	1 029.6	979.2	–4.9	20.5
Copper	708.9	716.2	1.0	15.0
Cement	348.6	305.9	–12.2	6.4
Zinc	273.2	276.1	1.1	5.8
Stone	238.4	218.6	–8.3	4.6
Total	5 101.5	4 780.5	–6.3	100.0
MANITOBA				
Nickel	588.3	567.0	–3.6	49.9
Copper	148.5	167.8	13.0	14.8
Zinc	113.2	123.4	9.0	10.9
Petroleum, crude	90.3	86.3	–4.4	7.6
Total	1 127.2	1 136.0	0.8	100.0

TABLE 12 (cont'd)

	Value of Production			
	1991	1992p	Change 1992/1991	1992p Proportion of Provincial Total
	($ million)		(percent)	
SASKATCHEWAN				
Petroleum, crude	1 186.5	1 392.6	17.4	45.6
Potash (K_2O)	x	x	x	x
Uranium (U)	332.8	382.5	14.9	12.5
Natural gas	332.3	297.6	–10.4	9.7
Total	2 863.0	3 052.7	6.6	100.0
ALBERTA				
Petroleum, crude	8 675.4	9 231.4	6.4	54.1
Natural gas	4 435.4	4 674.5	5.4	27.4
Natural gas by-products	2 103.8	2 213.4	5.2	13.0
Coal	554.0	572.1	3.3	3.3
Sulphur, elemental	304.0	115.2	–62.1	0.7
Total	16 372.9	17 078.6	4.3	100.0
BRITISH COLUMBIA				
Copper	916.6	880.1	–4.0	25.5
Coal	990.0	700.0	–29.3	20.3
Natural gas	564.4	568.9	0.8	16.5
Petroleum, crude	266.1	262.4	–1.4	7.6
Gold	244.6	202.1	–17.4	5.9
Zinc	161.1	188.2	16.8	5.5
Cement	x	x	x	x
Total	3 851.2	3 447.7	–10.5	100.0
YUKON				
Zinc	191.2	302.8	58.4	64.7
Lead	79.8	91.3	14.4	19.5
Gold	51.6	50.7	–1.7	10.8
Silver	12.9	17.8	38.0	3.8
Total	340.7	467.9	37.3	100.0
NORTHWEST TERRITORIES				
Zinc	221.5	261.5	18.1	40.0
Gold	223.5	182.8	–18.2	28.0
Petroleum, crude	202.3	142.5	–30.0	21.8
Lead	30.1	28.4	–5.6	4.3
Total	711.1	653.3	–8.1	100.0
CANADA				(Proportion of Canada Total)
Petroleum, crude	10 456.4	11 251.1	7.6	31.8
Natural gas	5 394.1	5 607.7	4.0	15.8
Natural gas by-products	2 178.1	2 296.8	5.4	6.5
Gold	2 349.9	2 086.8	–11.2	5.9
Copper	2 112.2	2 062.9	–2.3	5.8
Zinc	1 385.2	1 727.1	24.7	4.9
Nickel	1 807.6	1 679.9	–7.1	4.7
Coal	1 916.8	1 663.3	–13.2	4.7
Iron ore	1 228.2	1 129.4	–8.0	3.2
Potash (K_2O)	931.9	963.3	3.4	2.7
Grand total	35 205.2	35 411.5	0.6	100.0

Sources: Energy, Mines and Resources Canada; Statistics Canada.
– Nil; . . Not applicable; p Preliminary; x Confidential.

TABLE 13. PRODUCTION OF LEADING MINERALS, BY PROVINCE AND TERRITORY IN CANADA, 1992P

	Unit of Measure	Nfld.	P.E.I.	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskat-chewan	Alberta	British Columbia	Yukon	N.W.T.	Total Canada
	(000)													
Petroleum, crude	m^3	–	–	621	–	–	222	667	13 437	75 071	2 028	–	1 951	93 997
	$	–	–	102 330	–	–	33 558	86 306	1 392 577	9 231 416	262 412	–	142 496	11 251 095
Natural gas	000 m^3	–	–	–	–	–	433	–	6 214	97 616	14 065	–	598	118 925
	$	–	–	–	–	–	40 970	–	297 574	4 674 540	568 911	–	25 710	5 607 705
Natural gas	m^3	–	–	–	–	–	–	9	124	25 588	801	–	30	26 551
by-products	$	–	–	–	–	–	–	772	11 080	2 213 371	69 411	–	2 191	2 296 825
Gold	g	x	–	–	x	44 544	73 928	2 629	1 834	35	15 261	3 831	13 799	157 554
	$	x	–	–	x	589 985	979 183	34 818	24 290	464	202 130	50 747	182 773	2 086 803
Copper	kg	–	–	–	15 597	92 114	258 547	60 581	120	–	317 729	–	–	744 687
	$	–	–	–	43 206	255 167	716 205	167 816	332	–	880 148	–	–	2 062 873
Zinc	kg	–	–	x	294 978	101 832	190 822	85 263	x	–	130 088	209 263	180 708	1 193 607
	$	–	–	x	426 833	147 351	276 120	123 376	x	–	188 238	302 804	261 484	1 727 150
Nickel	kg	–	–	–	–	–	124 181	64 871	–	–	–	–	–	189 051
	$	–	–	–	–	–	1 112 874	566 978	–	–	–	–	–	1 679 853
Coal	t	–	–	4 500	400	–	–	–	9 350	33 350	16 950	–	–	64 550
	$	–	–	265 000	32 000	–	–	–	94 200	572 100	700 000	–	–	1 663 300
Iron ore	t	18 399	–	–	–	13 861	450	–	–	–	62	–	–	32 772
	$	680 247	–	–	–	x	x	–	–	–	1 292	–	–	1 129 371
Potash (K_2O)	t	–	–	–	x	–	–	–	x	–	–	–	–	7 324
	$	–	–	–	x	–	–	–	x	–	–	–	–	963 260
Cement	t	x	–	x	–	1 610	3 344	x	x	x	x	–	–	8 484
	$	x	–	x	–	94 339	305 906	x	x	x	x	–	–	739 211
Sand and gravel	t	2 859	1 144	5 402	7 045	30 721	62 329	7 475	5 627	35 689	39 883	1 691	1 217	201 082
	$	11 583	3 414	20 443	14 616	93 255	206 465	28 241	21 018	101 364	128 024	5 223	3 390	637 035
Uranium (U)	kg	–	–	–	–	–	988	–	8 069	–	–	–	–	9 057
	$	–	–	–	–	–	193 076	–	382 511	–	–	–	–	575 587
Stone	t	930	–	4 210	2 234	31 634	36 075	1 728	–	347	3 724	–	757	81 639
	$	4 947	–	19 799	13 404	205 775	218 572	8 705	–	4 309	28 766	–	3 368	507 645
Salt	t	–	–	x	x	x	6 648	–	544	1 245	–	–	–	11 100
	$	–	–	x	x	x	140 544	–	25 173	15 324	–	–	–	253 802
Asbestos	t	14	–	–	–	574	–	–	–	–	13	–	–	601
	$	4 593	–	–	–	224 826	–	–	–	–	6 341	–	–	235 760
Lead	kg	–	–	x	77 374	–	–	x	–	–	73 991	125 924	39 140	318 515
	$	–	–	x	56 096	–	–	x	–	–	53 644	91 295	28 377	230 923
Lime	t	–	–	–	x	x	1 455	x	–	186	x	–	–	2 383
	$	–	–	–	x	x	103 205	11 285	–	16 388	x	–	–	182 834
Silver	kg	x	–	x	239	138	213	44	x	–	373	118	23	1 147
	$	x	–	x	36 055	20 769	32 108	6 595	x	–	56 312	17 800	3 526	173 219
Cobalt	kg	–	–	–	–	–	1 764	454	–	–	–	–	–	2 219
	$	–	–	–	–	–	109 541	27 345	–	–	–	–	–	136 886
Sulphur, elemental	t	–	–	–	–	–	–	–	x	5 760	x	–	–	6 350
	$	–	–	–	–	–	–	–	x	115 160	x	–	–	131 385
Clay products	$	x	–	x	x	x	75 895	x	x	x	9 284	–	–	117 326
Platinum group	g	–	–	–	–	–	x	x	–	–	–	–	–	10 505
	$	–	–	–	–	–	x	x	–	–	–	–	–	117 099
Peat	t	1	–	x	309	332	–	x	x	100	–	–	–	856
	$	53	–	x	32 465	40 558	–	x	x	17 250	–	–	–	108 199
Gypsum	t	x	–	5 223	–	–	857	x	–	–	476	–	–	6 892
	$	x	–	55 164	–	–	13 924	x	–	–	x	–	–	79 206
Total leading minerals	$	733 930	3 414	538 515	870 548	2 168 439	4 678 714	1 123 112	3 030 774	17 078 646	3 347 076	467 869	653 315	34 694 353
Total all minerals	$	735 302	3 414	539 913	885 822	2 630 441	4 780 453	1 136 029	3 052 656	17 078 646	3 447 686	467 871	653 315	35 411 548
Leading minerals as % of all minerals		99.8	100.0	99.7	98.3	82.4	97.9	98.9	99.3	100.0	97.1	100.0	100.0	98.0

Sources: Energy, Mines and Resources Canada; Statistics Canada.
– Nil; P Preliminary; x Confidential.
Notes: Certain minerals are not included in the leading minerals due to confidentiality constraints. Confidential values are included in totals. Numbers may not add to totals due to rounding.

TABLE 14. PRODUCTION OF LEADING MINERALS, BY PROVINCE AND TERRITORY IN CANADA, 1991

	Unit of Measure	Nfld.	P.E.I.	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskat-chewan	Alberta	British Columbia	Yukon	N.W.T.	Total Canada
	(000)													
Petroleum, crude	m^3	–	–	–	–	–	235	713	12 390	72 478	2 046	–	1 927	89 788
	$	–	–	–	–	–	35 678	90 343	1 186 476	8 675 431	266 118	–	202 318	10 456 364
Natural gas	000 m^3	–	–	–	–	–	428	–	6 042	85 477	12 934	–	362	105 244
	$	–	–	–	–	–	45 295	–	332 299	4 435 417	564 431	–	16 631	5 394 073
Gold	g	x	–	–	x	51 923	77 170	2 921	2 899	34	18 331	3 865	16 752	176 126
	$	x	–	–	x	692 762	1 029 603	38 969	38 685	454	244 573	51 573	223 504	2 349 872
Natural gas	m^3	–	–	–	–	–	–	6	122	24 108	654	–	29	24 919
by-products	$	–	–	–	–	–	–	541	10 826	2 103 801	59 849	–	3 077	2 178 094
Copper	kg	–	–	x	10 476	113 931	261 899	54 875	x	–	338 642	–	–	780 362
	$	–	–	x	28 356	308 370	708 862	148 525	x	–	916 578	–	–	2 112 152
Coal	t	–	–	4 138	498	–	–	–	8 981	32 554	24 962	–	–	71 133
	$	–	–	245 240	34 185	–	–	–	93 865	553 980	989 510	–	–	1 916 780
Nickel	kg	–	–	–	–	–	125 790	62 309	–	–	–	–	–	188 098
	$	–	–	–	–	–	1 219 277	588 342	–	–	–	–	–	1 807 619
Zinc	kg	–	–	x	209 790	117 404	213 599	88 486	x	–	125 980	149 487	173 154	1 083 008
	$	–	–	x	268 322	150 160	273 193	113 173	x	–	161 129	191 194	221 464	1 385 167
Iron ore	t	19 799	–	–	–	14 905	650	–	–	–	67	–	–	35 421
	$	714 885	–	–	–	x	x	–	–	–	1 514	–	–	1 228 188
Potash (K_2O)	t	–	–	–	x	–	–	–	x	–	–	–	–	7 087
	$	–	–	–	x	–	–	–	x	–	–	–	–	931 932
Cement	t	x	–	x	–	2 267	3 761	x	x	x	x	–	–	9 372
	$	x	–	x	–	135 840	348 646	x	x	x	x	–	–	810 769
Sand and gravel	t	2 535	1 123	5 526	7 400	32 804	65 317	8 000	9 871	38 401	42 023	1 441	1 824	216 264
	$	11 396	3 261	21 667	13 483	113 299	233 239	28 355	41 513	127 307	135 852	5 214	6 739	741 326
Uranium (U)	kg	–	–	–	–	–	1 251	–	6 911	–	–	–	–	8 162
	$	–	–	–	–	–	262 714	–	332 753	–	–	–	–	595 467
Stone	t	1 270	–	4 632	2 591	34 801	38 704	1 725	–	321	2 779	–	1 003	87 826
	$	7 691	–	24 810	15 851	208 805	238 446	11 023	–	3 556	24 685	–	4 788	539 654
Sulphur, elemental	t	–	–	–	–	–	2	–	x	5 675	x	–	–	6 180
	$	–	–	–	–	–	136	–	x	303 960	x	–	–	335 381
Asbestos	t	9	–	–	–	614	–	–	–	–	63	–	–	686
	$	3 259	–	–	–	226 338	–	–	–	–	41 433	–	–	271 030
Salt	t	–	–	x	x	x	7 182	–	566	1 245	–	–	–	11 871
	$	–	–	x	x	x	136 305	–	27 032	15 335	–	–	–	259 166
Lead	kg	–	–	x	51 957	–	x	2 286	–	–	63 385	93 912	35 388	248 102
	$	–	–	x	44 163	–	x	1 943	–	–	53 878	79 825	30 080	210 886
Lime	t	–	–	–	x	x	1 439	x	–	218	x	–	–	2 375
	$	–	–	–	x	x	107 790	9 382	–	20 407	x	–	–	193 541
Silver	kg	x	–	x	158	164	294	43	x	–	497	87	17	1 261
	$	x	–	x	23 563	24 406	43 723	6 391	x	–	74 010	12 890	2 524	187 676
Platinum group	g	–	–	–	–	–	x	x	–	–	–	–	–	11 123
	$	–	–	–	–	–	x	x	–	–	–	–	–	150 155
Clay products	$	x	–	x	x	x	74 737	x	x	x	14 072	–	–	119 838
Peat	t	3	–	x	263	350	–	x	x	102	–	–	–	833
	$	141	–	x	28 510	40 221	–	x	x	15 639	–	–	–	100 133
Sulphur, in smelter	t	–	–	1	55	129	480	...	–	–	85	...	–	749
gas	$	–	–	116	8 247	20 568	47 293	3	–	–	12 958	3	–	89 187
Cobalt	kg	–	–	–	–	–	1 761	410	–	–	–	–	–	2 171
	$	–	–	–	–	–	61 768	15 781	–	–	–	–	–	77 549
Total leading minerals	$	768 311	3 261	384 466	670 688	2 467 912	5 027 686	1 109 508	2 839 158	16 368 070	3 751 115	340 698	711 126	34 442 001
Total all minerals	$	772 269	3 261	460 615	671 475	2 930 011	5 101 464	1 127 188	2 862 986	16 372 931	3 851 171	340 703	711 126	35 205 199
Leading minerals as % of all minerals		99.5	100.0	83.5	99.9	84.2	98.6	98.4	99.2	100.0	97.4	100.0	100.0	97.8

Sources: Energy, Mines and Resources Canada; Statistics Canada.
– Nil; ... Amount too small to be expressed; x Confidential.
Notes: Certain minerals are not included in the leading minerals due to confidentiality constraints. Confidential values are included in totals. Numbers may not add to totals due to rounding.

TABLE 15. CANADA, PERCENTAGE CONTRIBUTION OF LEADING MINERALS TO TOTAL VALUE OF MINERAL PRODUCTION, 1986-92

	1986	1987	1988	1989	1990r	1991	1992p
Petroleum, crude	29.6	33.4	24.8	27.7	32.1	29.7	31.8
Natural gas	17.3	12.7	14.1	13.7	14.0	15.3	15.8
Natural gas by-products	5.6	5.2	4.3	4.1	5.8	6.2	6.5
Gold	5.2	6.1	6.3	5.9	5.9	6.7	5.9
Copper	4.4	5.3	6.5	6.1	6.0	6.0	5.8
Zinc	3.7	4.1	6.1	7.0	5.6	3.9	4.9
Nickel	3.0	3.5	7.5	7.7	5.0	5.1	4.7
Coal	5.3	4.5	4.9	4.9	4.5	5.4	4.7
Iron ore	4.1	3.8	3.6	3.5	3.1	3.5	3.2
Potash (K_2O)	1.8	2.0	3.2	2.6	2.4	2.6	2.7
Cement	2.5	2.7	2.6	2.4	2.4	2.3	2.1
Sand and gravel	2.1	2.1	2.3	2.2	2.0	2.1	1.8
Uranium (U)	3.2	3.3	2.8	2.3	2.2	1.7	1.6
Stone	1.5	1.6	1.7	1.7	1.6	1.5	1.4
Salt	0.7	0.7	0.7	0.6	0.6	0.7	0.7
Asbestos	0.7	0.7	0.7	0.7	0.7	0.8	0.7
Lead	0.7	1.1	1.0	0.7	0.7	0.6	0.7
Lime	0.5	0.5	0.5	0.5	0.5	0.6	0.5
Silver	0.8	1.2	1.0	0.7	0.6	0.5	0.5
Cobalt	0.1	0.1	0.1	0.1	0.1	0.2	0.4
Sulphur, elemental	2.6	1.4	1.2	1.1	0.9	1.0	0.4
Clay products	0.6	0.6	0.5	0.5	0.3	0.3	0.3
Platinum group	0.6	0.5	0.5	0.4	0.5	0.4	0.3
Peat	0.2	0.2	0.2	0.3	0.2	0.3	0.3
Gypsum	0.3	0.2	0.2	0.2	0.2	0.2	0.2
Other minerals	2.9	2.4	2.6	2.4	2.3	2.2	2.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Sources: Energy, Mines and Resources Canada; Statistics Canada.
p Preliminary; r Revised.
Note: Numbers may not add to totals due to rounding.

TABLE 16. PRODUCTION OF CANADA'S TEN LEADING[1] MINERAL COMMODITIES, 1985-92

	Unit	1985	1986	1987	1988	1989	1990	1991	1992p
	(000)								
Petroleum	m^3	85 564	85 468	89 140	93 806	90 641	90 279	89 788	93 997
Natural gas	000 m^3	84 344	71 896	78 267	90 911	96 117	98 771	105 244	118 925
Natural gas by-products	m^3	19 682	19 127	21 560	22 556	23 055	23 863	24 919	26 551
Gold	g	87 562	102 899	115 818	134 813	159 494	167 373	176 126	157 554
Copper	kg	738 637	698 527	794 149	758 478	704 432	771 433	780 362	744 687
Zinc	kg	1 049 275	988 173	1 157 936	1 370 000	1 272 854	1 179 372	1 083 008	1 193 607
Nickel	kg	169 971	163 639	189 086	198 744	195 554	195 004	188 098	189 051
Coal	t	60 436	57 811	61 211	70 644	70 527	68 332	71 133	64 550
Iron ore	t	39 502	36 167	37 702	39 934	39 445	35 670	35 421	32 772
Potash (K_2O)	t	6 661	6 753	7 668	8 154	7 014	7 345	7 087	7 324

Sources: Energy, Mines and Resources Canada; Statistics Canada.
p Preliminary.
1 Based on contribution in 1992 to value of mineral production.

TABLE 17. CANADA, EMPLOYMENT IN THE MINERAL INDUSTRY, STAGE I - MINERAL EXTRACTION AND CONCENTRATING (TOTAL ACTIVITY),[1] 1961-92

	Metal Mines	Nonmetal Mines	Structural Materials	Nonfuel Mining	Coal	Crude Oil and Natural Gas	Total Nonfuel and Fuel
SIC#	061	062	081, 082	061, 062 081, 082	063	071	
				(number)			
1961	58 591	11 003	5 235	74 829	10 302	11 184	96 315
1962	58 243	11 408	5 514	75 165	9 897	11 232	96 294
1963	57 119	11 661	5 686	74 466	9 828	11 237	95 531
1964	57 648	11 727	6 044	75 419	9 796	11 242	96 457
1965	60 942	12 116	6 248	79 306	9 697	11 817	100 820
1966	61 670	12 422	6 312	80 404	9 281	12 378	102 063
1967	61 728	13 077	5 779	80 584	8 981	13 113	102 678
1968	63 369	13 673	5 836	82 878	8 427	13 611	104 916
1969	60 550	14 322	5 692	80 564	7 371	14 153	102 088
1970	66 590	15 150	5 510	87 250	7 874	14 970	110 094
1971	66 012	15 105	5 328	86 445	8 069	15 896	110 410
1972	61 994	14 866	5 154	82 014	8 704	16 604	107 322
1973	66 134	15 391	5 276	86 801	7 856	16 786	111 443
1974	70 038	16 198	6 197	92 433	8 142	18 155	118 730
1975	69 161	13 703	6 382	89 246	8 416	18 053	115 715
1976	68 269	15 649	5 685	89 603	8 995	19 096	117 694
1977	67 242	16 608	5 190	89 040	9 781	20 240	119 061
1978	56 447	16 035	4 847	77 329	10 574	22 045	109 948
1979	58 960	16 770	4 692	80 422	10 269	24 554	115 245
1980	66 118	16 979	4 461	87 558	11 416	27 448	126 422
1981	68 712	16 391	4 183	89 286	11 182	28 783	129 251
1982	61 503	13 680	3 491	78 674	13 113	31 699	123 486
1983	52 194	13 170	3 403	68 767	11 646	33 418	113 831
1984	52 683	13 698	3 560	69 941	11 905	33 944	115 790
1985	48 672	12 974	3 941	65 587	12 076	38 720	116 383
1986	46 487	12 376	4 887	63 750	10 747	34 936	109 433
1987	45 496	12 181	5 738	63 415	10 406	33 855	107 676
1988	48 277	11 679	5 917	65 873	11 122	33 762	110 757
1989	49 405	11 714	5 881	67 000	11 279	32 696	110 975
1990	45 248	11 515	5 376	62 139	11 504	31 926	105 569
1991p	42 014	10 744	5 015	57 773	11 498e	31 450	100 721
1992f	39 305	10 455	4 690	54 451	9 585	28 586	92 621

Sources: Energy, Mines and Resources Canada; Statistics Canada.
SIC: 1980 Standard Industrial Classification.
e Estimated; f Forecast; p Preliminary.
1 Total activity includes sales and head offices.

TABLE 18. CANADA, EMPLOYMENT IN THE NONFUEL MINERAL INDUSTRY, STAGE I – MINERAL EXTRACTION AND CONCENTRATING (TOTAL ACTIVITY),[1] 1961-92

	Gold	Uranium	Iron	Nickel, Copper, Zinc	Silver, Lead, Zinc	Other Nonferrous	Asbestos	Peat	Gypsum	Potash	Other Nonmetal	Stone Quarries	Sand and Gravel	Total Nonfuel Mining
SIC #	0611	0616	0617	0612, 0613	0614	0615, 0619	0621	0622	0623	0624	0625, 0629	081	082	
							(number)							
1961	15 994	(2)	8 446	23 351	4 524	6 276	6 773	1 207	549	(3)	2 424	3 173	2 062	74 829
1962	15 425	(2)	9 181	23 383	4 669	5 585	6 936	1 220	594	(3)	2 658	3 221	2 293	75 165
1963	14 639	(2)	9 608	22 703	5 163	5 006	6 828	1 303	677	(3)	2 853	3 477	2 209	74 466
1964	14 012	(2)	9 544	23 848	5 898	4 346	6 544	1 290	710	(3)	3 183	3 718	2 326	75 419
1965	13 155	(2)	11 739	25 892	6 121	4 035	6 536	1 201	646	1 050	2 683	3 511	2 737	79 306
1966	11 656	(2)	11 464	27 651	6 356	4 543	6 736	1 254	585	1 195	2 652	3 701	2 611	80 404
1967	10 355	(2)	10 899	29 288	6 030	5 156	6 931	1 261	505	1 724	2 656	3 381	2 398	80 584
1968	9 001	(2)	11 342	30 557	6 320	6 149	7 213	1 306	489	2 086	2 579	3 340	2 496	82 878
1969	8 221	(2)	10 490	28 679	6 467	6 693	7 242	1 156	657	2 713	2 554	3 252	2 440	80 564
1970	7 185	(2)	11 336	36 253	7 103	4 713	7 664	1 195	671	2 837	2 783	3 023	2 487	87 250
1971	6 148	(2)	11 524	37 713	6 506	4 121	8 101	1 269	603	2 519	2 613	2 832	2 496	86 445
1972	5 579	(2)	10 842	36 012	6 057	3 504	7 843	1 114	670	2 440	2 799	2 803	2 351	82 014
1973	5 603	(2)	13 395	37 602	6 112	3 422	8 027	1 236	676	2 684	2 768	3 097	2 179	86 801
1974	5 665	(2)	15 019	38 876	6 722	3 756	8 131	1 288	671	3 224	2 884	3 458	2 739	92 433
1975	5 798	(2)	16 155	35 538	7 362	4 308	6 042	1 303	576	3 351	2 431	3 544	2 838	89 246
1976	5 051	3 430	16 765	34 049	7 351	1 623	7 900	1 168	591	3 270	2 720	3 217	2 468	89 603
1977	4 643	4 140	15 550	33 703	7 512	1 694	8 302	1 244	652	3 628	2 782	3 004	2 186	89 040
1978	4 943	4 965	12 103	25 610	7 073	1 753	7 752	1 295	683	3 708	2 597	2 876	1 971	77 329
1979	5 013	5 858	14 563	25 116	7 081	1 329	8 067	1 372	738	3 905	2 688	2 860	1 832	80 422
1980	5 839	6 304	13 753	31 063	7 349	1 810	8 055	1 308	715	4 160	2 741	2 660	1 801	87 558
1981	6 809	6 869	12 397	33 246	7 740	1 651	6 829	1 441	711	4 661	2 749	2 418	1 765	89 286
1982	7 350	6 035	10 676	28 851	6 837	1 754	4 973	1 323	614	4 076	2 694	2 028	1 463	78 674
1983	7 956	5 390	8 236	24 953	5 073	586	4 617	1 301	682	3 696	2 874	1 980	1 423	68 767
1984	8 450	6 249	7 843	24 000	5 165	976	4 177	1 369	770	4 508	2 874	2 256	1 304	69 941
1985	7 862	5 989	7 077	22 073	4 724	947	3 569	1 363	753	4 488	2 801	2 340	1 601	65 587
1986	8 562	5 608	6 379	20 616	4 162	1 160	2 766	1 468	990	4 315	2 837	2 627	2 260	63 750
1987	9 757	5 289	6 039	18 979	4 372	1 060	2 858	1 510	929	4 094	2 790	2 911	2 827	63 415
1988	12 594	5 103	6 095	18 881	4 443	1 161	2 720	1 581	956	3 970	2 452	2 981	2 936	65 873
1989	12 631	4 839	6 303	19 837	4 487	1 308	2 800	1 713	965	3 893	2 343	3 145	2 736	67 000
1990	11 807	3 702	5 820	19 581	3 921	1 090	2 699	1 740	786	3 822	2 471	2 951	2 425	62 815
1991p	10 552	2 391	5 683	18 607	3 459	1 322	2 423	1 469	632	3 825	2 395	2 707	2 308	57 773
1992f	9 951	1 939	5 359	17 547	3 262	1 247	2 358	1 429	615	3 722	2 331	2 683	2 008	54 451

Sources: Energy, Mines and Resources Canada; Statistics Canada.
f Forecast; p Preliminary.
1 Total activity includes sales and head offices. (2) Included in "Other Nonferrous." (3) Included in "Other Nonmetal."

TABLE 19. CANADA, EMPLOYMENT IN THE MINERAL INDUSTRY, STAGE II - SMELTING AND REFINING (TOTAL ACTIVITY),[1] 1961-92

	Smelting/ Refining	Iron and Steel Mills	Total Primary Metals	Petroleum Refineries	Total Smelting and Refining
SIC#	295	291	291, 295	3611	
			(number)		
1961	29 938	34 749	64 687	10 660	75 347
1962	29 693	36 593	66 286	10 184	76 470
1963	28 516	38 196	66 712	9 734	76 446
1964	30 153	41 505	71 658	9 547	81 205
1965	31 835	44 274	76 109	8 976	85 085
1966	34 237	45 999	80 236	8 996	89 232
1967	34 764	44 203	78 967	9 147	88 114
1968	34 710	44 634	79 344	9 091	88 435
1969	33 376	42 954	76 330	8 765	85 095
1970	37 298	49 169	86 467	14 725	101 192
1971	36 445	49 601	86 046	14 506	100 552
1972	33 829	49 758	83 587	14 376	97 963
1973	32 396	53 008	85 404	14 843	100 247
1974	35 249	54 253	89 502	15 967	105 469
1975	35 577	54 003	89 580	15 624	105 204
1976	34 246	51 978	86 224	15 105	101 329
1977	35 647	52 709	88 356	16 464	104 820
1978	32 652	56 669	89 321	18 958	108 279
1979	32 869	59 167	92 036	18 037	110 073
1980	36 137	61 238	97 375	18 743	116 118
1981	38 011	56 543	94 554	21 325	115 879
1982	33 215	52 330	85 545	20 155	105 700
1983	31 788	47 693	79 481	17 557	97 038
1984	31 752	48 899	80 651	15 847	96 498
1985	30 567	47 685	78 252	15 326	93 578
1986	29 058	46 461	75 519	13 287	88 806
1987	29 397	46 493	75 890	13 252	89 142
1988	30 099	48 259	78 358	13 358	91 716
1989	30 651	46 738	77 389	13 881	91 270
1990e	29 974	39 722	69 696	12 741	82 437
1991p	27 040a	36 624	63 664a	11 654	75 317
1992f	23 634a	34 265	57 898a	11 627	69 525

Sources: Energy, Mines and Resources Canada; Statistics Canada.
e Estimated; f Forecast; p Preliminary.
a Change is partially due to the reclassification of a unit from SIC 295 to SIC 296 effective May 1991.
1 Total activity includes sales and head offices.

TABLE 20. CANADA, EMPLOYMENT IN THE MINERAL INDUSTRY, STAGE III - SEMI-FABRICATION (TOTAL ACTIVITY),[1] 1961-92

	Total Nonfuel Semi-Fabrication	Miscellaneous Petroleum and Coal Products	Lubricating Oil and Greases	Total Semi-Fabrication
SIC#		369	3612	
		(number)		
1961	77 063	581	331	77 975
1962	80 606	608	352	81 566
1963	82 420	635	354	83 409
1964	87 843	726	373	88 942
1965	93 912	531	408	94 851
1966	98 602	585	424	99 611
1967	96 033	546	407	96 986
1968	96 375	518	397	97 290
1969	99 438	532	438	100 408
1970	96 144	499	423	97 066
1971	95 831	561	450	96 842
1972	101 109	555	478	102 142
1973	105 884	757	487	107 128
1974	109 818	954	514	111 286
1975	104 296	984	656	105 936
1976	103 411	982	602	104 995
1977	101 257	716	669	102 642
1978	107 234	683	712	108 629
1979	111 231	461	695	112 387
1980	105 902	532	798	107 232
1981	103 192	584	729	104 505
1982	90 194	571	792	91 557
1983	86 814	503	857	88 174
1984	91 405	521	896	92 822
1985	94 515	513	900	95 928
1986	96 744	778	1 001	98 523
1987	99 963	894	1 002	101 859
1988	103 307	1 161	1 091	105 559
1989	101 419	1 135	1 029	103 583
1990e	94 078	939	944	95 961
1991p	83 263	823	863	84 949
1992f	82 160	815	861	83 837

Sources: Energy, Mines and Resources Canada; Statistics Canada.
e Estimated; f Forecast; p Preliminary.
1 Includes sales and head offices.

TABLE 21. CANADA, EMPLOYMENT IN THE MINERAL INDUSTRY, STAGE III - NONFUEL SEMI-FABRICATION (TOTAL ACTIVITY),[1] 1961-92

	Steel Pipe and Tube	Iron Foundries	Aluminum Rolling, Casting, Extruding	Copper Rolling, Casting, Extruding	Other Rolling, Casting, Extruding	Wire and Wire Products	Clay and Clay Products	Cement	Concrete Products	Ready-Mix Concrete	Glass and Glass Products[2]	Abrasives	Lime	Other Non-metallic Products	Total Nonfuel Semi-Fabrication
SIC#	292	294	296	297	299	305	351	352	354	355	356	357	358	359	
								(number)							
1961	3 407	8 178	5 095	3 482	2 731	12 227	5 327	3 590	8 503	4 232	9 802	2 481	847	7 161	77 063
1962	3 676	8 546	5 118	3 492	2 770	13 045	5 468	3 679	9 156	4 886	10 042	2 577	949	7 202	80 606
1963	3 840	8 216	5 164	3 651	3 038	13 743	5 376	3 566	9 317	5 411	10 346	2 464	886	7 402	82 420
1964	4 437	9 620	4 834	3 849	3 382	14 850	5 582	3 592	10 225	6 171	10 362	2 580	815	7 544	87 843
1965	4 799	11 714	4 654	3 620	3 736	16 099	5 675	3 837	10 988	6 559	10 873	2 821	800	7 737	93 912
1966	4 795	13 027	4 943	4 199	4 103	16 391	5 876	4 053	11 090	7 349	11 248	3 044	785	7 699	98 602
1967	5 012	11 970	5 468	4 027	4 287	16 060	5 559	3 972	10 321	7 137	11 388	2 734	724	7 374	96 033
1968	5 441	11 131	5 491	3 947	4 585	16 082	5 515	3 747	10 166	7 440	11 992	2 617	662	7 559	96 375
1969	5 146	11 582	6 028	3 922	4 856	17 014	5 383	3 778	11 011	7 509	12 031	2 697	707	7 774	99 438
1970	5 314	10 663	6 297	3 744	4 060	16 598	4 938	3 887	9 562	7 340	11 654	2 559	660	8 868	96 144
1971	5 306	9 897	5 612	3 608	3 845	16 272	4 682	3 954	10 719	7 997	11 672	2 310	670	9 287	95 831
1972	6 268	9 948	6 200	3 740	4 215	17 651	4 695	4 732	10 817	8 240	12 045	2 367	651	9 540	101109
1973	5 288	10 965	6 206	3 736	4 863	18 877	5 001	4 871	10 790	9 233	12 840	2 555	724	9 935	105 884
1974	5 845	12 054	6 162	3 779	4 877	19 535	5 289	4 666	11 602	9 219	12 915	2 676	840	10 359	109 818
1975	5 785	11 480	5 672	3 240	4 573	17 614	5 042	4 577	11 201	9 541	11 779	2 318	790	10 684	104 296
1976	5 546	10 365	6 255	3 297	5 354	17 573	4 791	4 517	10 773	9 128	11 836	2 535	804	10 637	103 411
1977	5 634	10 459	6 884	3 183	4 703	17 886	4 553	4 265	10 001	8 521	11 204	2 557	828	10 579	101 257
1978	6 289	10 472	7 060	3 586	5 268	18 823	4 366	4 520	10 486	9 520	11 595	2 678	784	11 787	107 234
1979	6 480	10 520	7 698	3 728	6 292	19 765	4 947	4 828	9 766	9 332	11 835	2 660	925	12 455	111 231
1980	6 514	9 245	6 627	3 230	5 749	18 529	4 875	4 791	9 280	9 348	11 967	2 628	1 003	12 116	105 902
1981	7 531	8 358	6 512	3 031	5 182	17 309	4 145	4 726	9 121	10 053	12 003	2 571	968	11 682	103 192
1982	6 017	8 163	6 255	2 541	4 694	14 575	3 004	4 317	8 245	8 034	11 016	2 170	895	10 268	90 194
1983	4 521	7 364	6 415	2 744	4 827	13 493	3 008	4 057	7 286	8 390	11 896	1 852	862	10 099	86 814
1984	5 482	7 911	6 661	2 971	5 274	14 212	3 070	3 771	7 657	8 802	12 754	1 949	876	10 015	91 405
1985	5 978	7 750	6 196	3 012	5 620	15 354	2 727	3 533	8 336	9 210	12 872	1 895	783	11 249	94 515
1986	4 829	7 547	6 200	3 059	6 357	15 262	3 770	3 514	9 174	10 422	13 448	1 827	778	10 557	96 744
1987	4 964	7 860	6 143	2 828	6 403	14 943	3 930	3 646	10 309	11 910	13 605	1 693	784	10 945	99 963
1988	6 008	8 095	6 124	3 040	7 049	15 154	3 261	3 388	11 386	12 461	13 336	1 917	873	11 215	103 307
1989	5 438	7 538	6 285	3 119	6 645	15 077	3 044	3 350	11 505	12 377	12 664	2 039	871	11 467	101 419
1990e	5 058	6 546	5 813	2 594	5 761	13 835	2 896	3 362	10 911	11 142	11 212	1 940	829	12 178	94 078
1991p	5 595	5 489	7 612[a]	2 030	4 514	11 727	2 444	2 326	9 168	10 365	9 678	1 637	699	9 979	83 263
1992f	5 285	4 870	9 176[a]	1 740	4 541	12 242	2 596	2 255	8 409	10 991	7 962	1 593	694	9 807	82 160

Sources: Energy, Mines and Resources Canada; Statistics Canada.
e Estimated; f Forecast; p Preliminary.
a Increase is primarily due to the reclassification of an establishment from SIC 295 to SIC 296 effective May 1991.
1 Includes sales and head offices. 2 Includes sealed window manufacturers until 1969; thereafter, these are included in Stage IV - Ornamental Metal Products.

TABLE 22. CANADA, EMPLOYMENT IN THE MINERAL INDUSTRY, STAGE IV - METALLIC MINERAL MANUFACTURING (TOTAL ACTIVITY),[1] 1961-92

	Boilers	Structural Metal Products	Ornamental Metal Products	Stamped, Pressed and Coated Products	Hardware Tool and Cutlery	Heating Equipment	Machine Parts	Other Metal Fabricating	Total Mineral Manufacturing
SIC#	301	302	303	304	306	307	308	309	
					(number)				
1961	4 709	14 231	10 641	21 156	9 135	5 137	7 756	15 249	88 014
1962	4 886	14 802	11 640	23 606	10 223	5 349	8 603	16 283	95 392
1963	5 350	14 212	12 459	24 024	11 112	5 586	9 179	16 627	98 549
1964	5 429	14 602	12 808	25 192	13 110	5 673	10 137	18 088	105 039
1965	6 496	18 072	13 439	27 925	13 570	5 711	11 618	20 017	116 848
1966	7 239	21 038	13 488	29 577	14 326	5 464	13 235	21 431	125 798
1967	6 622	18 547	12 994	29 830	14 056	5 461	13 810	21 007	122 327
1968	7 962	17 150	12 664	29 560	14 166	4 930	13 501	20 825	120 758
1969	7 494	18 203	12 784	30 463	14 401	5 059	14 517	20 895	123 816
1970	7 661	19 104	12 417	29 709	15 241	4 670	14 221	20 543	123 566
1971	7 847	17 556	12 614	28 710	14 920	4 749	13 097	20 755	120 248
1972	8 136	17 113	13 611	27 939	16 386	4 238	11 731	21 504	120 658
1973	8 013	18 164	13 937	30 026	18 819	4 453	10 138	22 494	126 044
1974	8 681	20 020	14 470	31 276	20 234	4 930	10 936	23 663	134 210
1975	10 211	19 101	15 241	30 273	18 990	4 717	10 922	23 810	133 265
1976	10 704	18 056	15 541	31 487	19 316	4 977	10 764	23 704	134 549
1977	9 660	17 209	14 800	30 888	17 867	4 538	10 762	23 298	129 022
1978	9 124	16 759	16 753	34 181	18 856	5 086	12 029	24 904	137 692
1979	9 477	18 676	18 018	33 548	21 090	5 818	13 081	23 705	143 413
1980	10 374	17 700	17 890	32 266	20 830	5 993	13 449	24 217	142 719
1981	11 215	18 445	17 603	32 459	19 575	5 806	14 297	22 123	141 523
1982	10 965	17 021	15 228	29 865	17 342	5 317	13 083	18 167	126 988
1983	5 413	18 437	13 537	27 947	16 609	5 032	12 881	16 044	115 900
1984	4 548	17 162	13 538	27 758	17 308	4 220	14 200	16 256	114 990
1985	4 455	18 083	15 598	31 021	19 297	5 607	15 356	14 927	124 344
1986	4 990	19 213	17 462	31 584	21 164	5 779	17 259	15 170	132 621
1987	4 816	18 615	19 770	35 329	22 129	6 252	18 398	16 358	141 667
1988	6 182	19 689	20 795	36 976	23 042	6 390	22 681	17 887	153 642
1989	5 407	23 006	22 591	36 707	25 626	7 076	24 639	20 099	165 151
1990e	5 708	21 115	22 212	33 170	23 956	6 414	24 780	19 417	156 771
1991p	6 038	16 593	15 875	30 818	21 983	5 261	21 239	17 043	134 852
1992f	6 002	14 854	14 964	25 099	26 952	5 425	23 312	17 385	133 993

Sources: Energy, Mines and Resources Canada; Statistics Canada.
e Estimated; f Forecast; p Preliminary.
1 Total activity includes sales and head offices.

TABLE 23. CANADA, EMPLOYMENT FOR SERVICES INCIDENTAL TO MINES, QUARRIES AND OIL WELLS, 1961-92[1]

	Petroleum and Natural Gas Contract Drilling	Mining Diamond Drilling	Other Services Incidental to Mines, Quarries	Total
		(number)		
1961	4 144	2 025	1 409	7 578
1962	3 800	1 926	1 720	7 446
1963	4 179	2 201	1 491	7 871
1964	4 158	2 401	2 077	8 636
1965	4 648	2 776	3 137	10 561
1966	4 428	2 887	4 317	11 632
1967	4 249	2 669	5 425	12 343
1968	4 434	2 985	6 350	13 769
1969	4 821	3 109	6 967	14 897
1970	4 267	3 207	7 894	15 368
1971	4 093	2 514	7 710	14 317
1972	4 817	2 083	6 139	13 039
1973	5 680	2 123	5 193	12 996
1974	5 054	2 317	5 017	12 388
1975	5 096	1 899	4 139	11 134
1976	5 486	1 548	5 043	12 077
1977	6 054	1 682	5 723	13 459
1978	7 419	1 681	7 492	16 592
1979	9 076	2 420	8 436	19 932
1980	11 097	2 959	9 327	23 383
1981	8 448	2 721	9 856	21 025
1982	6 882	1 880	7 752	16 514
1983	12 032	1 575	12 254	25 861
1984	27 059	1 684	10 602	39 345
1985	30 146	1 625	12 191	43 962
1986	25 290	2 198	11 582	39 069
1987	24 527	3 353	11 174	39 054
1988	26 216	3 201	12 384	41 801
1989	23 513	2 072	11 052	36 637
1990	22 779	1 848	9 540	34 166
1991p	24 058	1 395	8 606	34 059r
1992f	18 788	1 395	7 166	27 348

Sources: Energy, Mines and Resources Canada; Statistics Canada.
f Forecast; p Preliminary; r Revised.
1 From 1961 to 1983, Petroleum and Natural Gas Contract Drilling included SIC Code 0911, Mining Diamond Drilling included SIC Code 0921, and Other Services Incidental to Mines, Quarries and Oil Wells included both SIC Codes 0919 and 0929. For data beginning in the year 1984, these series changed. Petroleum and Natural Gas Contract Drilling includes both SIC Codes 0911 and 0919, Mining Diamond Drilling includes SIC Code 0921, and Other Services Incidental to Mines and Quarries (excluding Oil Wells) includes SIC Code 0929 only.